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AGRICULTURAL RESEARCH INSTITUTE
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OF

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

WITH

AN ABSTRACT OF THE PROCEEDINGS AT BOARD AND GENERAL
MEETINGS, AND THE PREMIUMS OFFERED BY THE
SOCIETY IN 1890

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CONTENTS.

PAGE

1. RAILWAY REFRIGERATOR TRUCKS OR CARS. By D. TALLERMAN 1
2. CATTLE INSURANCE IN THE RHINS OF GALLOWAY. By W. H. RALSTON 19
3. THE GROWTH OF TREES. By WILLIAM SOMERVILLE, D.Œc., B.Sc., F.R.S.E. 26
4. ON THE MARINE LIFE DESTROYED BY THE TRAWL, AND ITS INFLUENCE ON FISH LIFE. By W. ANDERSON SMITH . 44
5. TREES AND SHRUBS BEST ADAPTED FOR PLANTING AS SHELTER IN THE ISLANDS OF SCOTLAND. By ROBERT HUTCHISON . 50
6. TRAWL-NET FISHING: ITS EFFECT ON MARINE LIFE. By JAMES G. BERTRAM 58
7. CHANGE IN CROPPING TO SUIT ALTERED CONDITIONS OF FARMING. By JOHN SPEIR 65
8. TREES AND SHRUBS BEST ADAPTED FOR PLANTING AS SHELTER IN THE ISLANDS OF SCOTLAND. By A. D. WEBSTER . 78
9. FORAGE CROPS SUITABLE FOR SCOTLAND. By JOHN SPEIR . 96
10. THE CEDAR OF LEBANON (*CEDRUS LIBANI*), AND ITS PROGRESS AND SUITABILITY AS A FOREST AND TIMBER TREE IN SCOTLAND SINCE ITS INTRODUCTION. By ROBERT HUTCHISON 112
11. GENERAL SHOW OF THE HIGHLAND AND AGRICULTURAL SOCIETY, HELD AT MELROSE IN 1889 128
12. SYSTEM OF MANAGEMENT IN BREEDING STUDS OF DRAUGHT-HORSES. By ARCHIBALD MACNEILAGE 136
13. THE CEREAL AND OTHER CROPS OF SCOTLAND FOR 1889, AND METEOROLOGY OF THE YEAR RELATIVE THERETO—
    - The Crops 160
    - The Meteorology. By Dr Alexander Buchan . . 181
14. AGRICULTURAL STATISTICS OF SCOTLAND, EXTRACTED FROM THE GOVERNMENT RETURNS 188
15. AVERAGE PRICES OF HOME-GROWN WHEAT, BARLEY, AND OATS IN WEEKLY MARKET OF EDINBURGH, FOR 1888 AND 1889 195

16. Prices of Sheep since 1818 196
17. Prices of Wool since 1818 198
18. Botanical Investigation of the Pastures of Scotland. By A. N. M'Alpine, Botanist to the Society . . 199
19. Fruit-Farming. By Cecil H. Hooper, F.H.A.S. . . 232
20. Calf-Rearing. By Rev. John Gillespie, A.M. . . 252
21. Report of Experiments with Turnip Manure in Kincardineshire. By John Hart 267
22. Chemical Department. Reports by Dr Andrew P. Aitken, Chemist to the Society—
    Feeding Experiments in various parts of Scotland . . 289
        The Ratio of Albumen to Carbohydrates most suitable in the Dietary of Feeding Cattle (Experiment X.) . 289
        The Relative Importance of Oil and Sugar as Bye-Fodders (Experiment XI.) 319
        The Relative Values of Cake and Mixed Grains (Barley and Oats) as Bye-Fodders (Experiment XIII.) . 327
    Manurial Experiments 332
        The most Economical Turnip Manure (Experiment II.) 333
        Slag *versus* Superphosphate (Experiment III.) . . 347
        Bones *versus* Superphosphates (Experiment IV.) . 350
        Manuring of Beans, Oats, and Hay 353
    Pumpherston Experimental Station—
        Grass Crop, 1889 359
        Botanical Analyses of Second Year's Grass . . 368
    Analytical Associations—
        Report for 1889 378
        Analyses in connection with Feeding Experiments . 378
        Laboratory Notes 381
23. Epizootic Abortion. By J. M'Fadyean, M.B., B.Sc., F.R.S.E. 389

APPENDIX (A).

Proceedings of the Society at Board and General Meetings 1
Premiums awarded by the Society in 1889 31
Accounts of the Society for 1889 56

APPENDIX (B).

Premiums offered by the Society in 1890 1
Members admitted since the List was published in April 1889 87

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TRANSACTIONS

OF

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

RAILWAY REFRIGERATOR TRUCKS OR CARS.

By D. TALLERMAN, 50 Redcliffe Road, South Kensington, S.W.

[Premium—*Ten Sovereigns.*]

THE refrigerator "car" or railway truck is an American institution of comparatively recent introduction, the employment of which has yielded advantages of so marked a character that its use in America has spread with great rapidity in all directions, while it has invariably proved the means of completely altering the nature of existing trades, or opening up new ones with beneficial results to whole districts. The farmers, fishermen, and landlords of the North of Scotland, and all trades identified with their progress, cannot fail to be interested in a recital of the developments of trade that refrigerator cars have created in the United States, and been the means of bringing the produce of their prairies, orchards, and rivers within reach of British consumers, from which they will gather how readily the remote districts of the Highlands might be brought into direct communication with the densely populated counties of the metropolitan and midland areas, whose people would prove ready purchasers of every description of produce that could be sent to them at prices satisfactory alike to producers and consumers, which, in time, would provide profitable employment, not only for the land and the people, but for all engaged in the fishing industries, and thus open up for them available home markets, thereby rendering them independent of foreign ones with all their attendant expenses. That the men of "light and leading" in Scotland have not kept watch on what has been doing abroad, and made efforts to bring into operation for their own country whatever might prove useful, is evident by the isolated position, from centres of consumption, the districts of the north still occupy. This condition of things cannot continue to exist without many of her prominent men feeling that a grave responsibility rests upon themselves personally, for not taking active steps to bring about such an alteration in the state of affairs as would create beneficial results for a people who are unable to help themselves.

It may be noted that, prior to the introduction of refrigerator cars in America, the cattle trade there was centred at Chicago, from whence all the animals were transmitted, alive, by rail to New York, Boston, Philadelphia, and other eastern cities, whence, after arrival and slaughter, a considerable quantity of beef was shipped to the English markets in vessels fitted with refrigerating chambers. Subsequent to this, some of the parties engaged in the trade, noting the benefits that arose from the shipment of the dead meat over that of the live cattle, and being acquainted with the serious amount of waste of quantity and great depreciation of quality that took place in the cattle during the railway journey from Chicago to New York, conceived the idea of fitting up a railway car as a cool chamber and slaughtering the cattle at Chicago, sending through the meat only in such forms as might be found suitable. Trials were made, and the results proved far more beneficial than had been anticipated, and led to the creation of the "dressed beef" business, which forced itself to the front despite the powerful opposition of the concentrated energies and capital of those engaged in the live-stock industry. The authorities of the American Government departments have continued to make reference to the subject in their reports, and explicitly pointed out the result of their observations; thus the Chief of the Bureau of Animal Industry, in his report for 1885, states:—

"The economy and practicability of shipping dressed beef from Chicago, St Louis, Kansas City, and other points, as far east as the seaboard States, I take to be an established fact, and, in the few remarks I have to make upon the subject, I shall discuss the advisability of establishing abattoirs and refrigerators at points further west, and within easy reach of the ranges of the west. The advantages of this mode of shipment have proved to be threefold: (1) the saving of freight on the offal and other gross matter, which saving should be greater; (2) the saving of shrinkage; (3) the animals are killed when they are in a better condition than they possibly could be if shipped alive to the eastern markets, and therefore beef of a superior quality is obtained."—Pp. 316, 317.

"The loss by shrinkage is about 100 lb. per head in shipping, and the damage averages on many thousands shipped, one and a half head per 1000 in killed and damaged."—P. 329.

The Report of the Statistical Department upon the Internal Commerce for the United States for 1885 states:—

"It is evident, however, that the only important practicable improvements in the best transportation system lies in the direction of shipping the carcass instead of the live animal, and thus, at the same time, saving the expense of hauling the waste matter in the steer, and bringing the meat to the consumers in as good condition as when the creature is driven from the range. The railroad companies, being fully equipped with cattle-cars, naturally take a conservative view of, and are disposed to look with small favour on, a change that will make this equipment useless, and would require the construction of expensive refrigerator cars."—P. 175.

"The increased facilities for making dressed beef, and increased sales of the article, show conclusively that there is an increasing demand for it. When dressed beef was first introduced it met with considerable opposition, especially on the part of shippers of cattle on foot to the eastern markets; but experience has shown that the meat reaches the consumer, when slaughtered and dressed and put in refrigator cars, in a much better condition than if sent on hoof. Regular trains of dressed beef are now sent to the seaboard and intermediate points laden with dressed beef every day, notwithstanding the considerable advances from time to time made in freight charges, and the submission of the shippers to what has appeared to them to be an arbitrary proceeding instigated at the suggestion of those shipping beef on the hoof.

"The increase in the refrigerator car business is just equal to the increase in the total receipts of cattle at the starting-place of those cars, which shows that the new way is steadily encroaching upon the ground of the old, and despite the vast amount of capital arrayed against it."—Pp. 186, 187.

"There is a very important branch of the dressed beef trade, which has been inaugurated within the past twelve months, and which is rapidly growing. It is the consignment of mixed carloads of beef, pork, and mutton, which are forwarded to the smaller distributing points all over the country, to supply the local trade. Merchants in the leading manufacturing districts of the eastern and middle States, and also in the lumbering districts of the north-west, forward their orders in our markets for small quantities of fresh meats for immediate use, which are forwarded in refrigerator cars. Not only are the leading slaughterers engaged in this business, but smaller houses have commenced operations. It is estimated that, outside the number of hogs slaughtered for packing and city consumption during the winter, at least 50,000 were slaughtered for the dressed meat trade, of the consignments of which there has been no special record kept. The number of sheep slaughtered for the dressed meat trade is quite large—possibly one-third of the receipts—but no definite figure can be given."—P. 270.

Evidence of Hon. Morton Post, of Wyoming:—

"*Question.* What do you think of the proposition to slaughter beef in Wyoming, and ship the carcasses east instead of the living animals?

"*Answer.* I think it would be a desirable improvement, and a great advantage to the stock interest, besides furnishing the consumers a clean and wholesome class of beef, free from the bruises and feverishness incident to shipping cattle alive, especially our range animals, which are highly nervous and excitable.

"*Question.* Do you think it would be a paying investment to establish slaughtering-places at Wyoming?

"*Answer.* I am not posted as to the business of slaughtering, but it occurs to me that if it is a good business to be carried on in Chicago, it would certainly be more profitable to slaughter the cattle near the ranges.

"*Question.* In view of the fact that the carcasses weigh only about 57 per cent of the weight of the live animals, would not this difficulty arise—that the remaining 43 per cent, representing the hides, hoofs, horns, and other parts, including offal, which is now utilised in the various industries of the city of Chicago, could not be so profitably disposed of in Wyoming?

"*Answer.* In my opinion, it would cost less to ship the hides, hoofs, blood, horns, &c., of the animal, after being slaughtered, than to ship it in the shape of live animals. The railway companies would lose very little in the matter of total weight-haul, from the fact that the hides, hoofs, horns, and blood would also be shipped, but in more compact forms, making more desirable freights for the railroads."—P. 281.

"*Question.* What is the average shrinkage of stock in being transported from Cheyenne to Chicago?

"*Answer.* I think about 100 lb. to each 1200 lb. animal. Cheyenne is the great centre for the cattle trade of the northern ranges."—P. 282.

Mr W. H. Miller, Secretary of the Kansas City Board of Trade:—

"My records show a shipment of 12,746,870 lb. of fresh beef from this point (Kansas City), of which 7,934,770 lb. went by eastward lines. Some of this beef has been shipped to the Atlantic seaboard cities, but how much I have no means of telling."—P. 283.

As a consequence of these movements, the "dressed beef" trade became an established fact, but it was not allowed to quickly and peaceably occupy its position. The vested interests that had grown up with, and were occupied in, the live cattle trade, promptly saw the danger that their business was in, and used every possible effort to obstruct the working of the new trade, as the following, taken from the before-mentioned Report of the Bureau of Animal Industry, 1885, shows: "In this connection it is proper to speak of the relative tariff rates charged by the railroads on live and dressed beef. When the rate from Chicago to New York was 40 cents per hundred pounds on live cattle, the dressed beef rate was 70 cents. The latter rate would indicate that the railroads were determined not to be deprived of the revenue which would be derived from transporting the cattle alive, even though the bulk and weight be reduced one-half, greatly increasing the facilities for handling, and diminishing in the same ratio the risks to the railroad corporations."—P. 317. And by their controlling power with the railway, caused a differential rate of carriage to be established, so that while live animals were conveyed from Chicago to New York at the rate of 40 cents or 1s. 8d. the hundred pounds, dead meat was made to pay 70 cents or 2s. 11d. the hundred pounds—in addition, the consignors providing their own ice. Notwithstanding this differential rate of 75 per cent additional, which still continues to exist, the dressed meat trade has continued to develop itself and extend its proportions until it now comprises 70 per cent of the cattle that reach Chicago—only 30 per cent being sent alive, or, as it is termed in America, "on the hoof."

The figures in connection with the trade from its commencement to the present time are most instructive, furnishing as they do by their extent conclusive evidence of the inherent advantages attending that system of meat transport, and the readiness that it might be brought into operation in our own districts, which are within one-half the distance of the centres of consumption that the western market is to the eastern States, and with the advantage of a much lower range of temperature. The official returns of the American Agricultural Department show that the quantities of each year were as follows:—

Report of Messrs Howard, White, & Co., Chicago, 1885:—

"It is in the dressed beef trade that the largest increase is shown during the year just closed (1884). Early in 1884 butchers and other interested parties in the east made a great fight against western dressed beef, and an effort was even made to induce the New York Legislature to enact a law hostile to it. Despite opposition, the business has flourished and grown beyond all expectations, and, as a matter of fact, is about the only local industry that can demonstrate by actual figures a marked increase over the previous year. Our operators now have cold storage rooms in all the principal cities and towns of the eastern and New England States, and it has been demonstrated over and over again that meat can be kept in perfect condition for two months, if need be. Consumers have generally come to consider beef handled this way with great favour."—P. 268.

"Chicago Beef Trade, 1884-85.—Number of cattle slaughtered during the past twelve months, 1,250,301, of which about 70 per cent were required for the dressed beef trade."—P. 269.

"In order to exhibit the enlargement of the trade in dressed beef, the following table is presented, showing the receipts and shipments by railway during the past two years—

	Received. lb.	Shipped. lb.
1884	4,407,830	377,955,997
1883	1,334,769	314,600,149
Increase . .	3,073,061	63,355,848

The increase in the receipts is about 230 per cent, and the shipments were enlarged about 20 per cent."—P. 270.

While the meat trade has thus developed itself into an entirely fresh direction in one way by the utilisation of refrigerator cars, the fruit trade has also by the same means acquired a position it never before held, and growers of remote States are brought within easy reach of the centres of consumption. Fresh ripe peaches, grapes, and other tender fruits from California and the Pacific coast, as well as strawberries and similar soft and tropical fruits from Florida and the southern States, are regularly transmitted to the markets of eastern and northern cities, where they invariably arrive in good order and condition, after journeys exceeding 2000 miles in length, and occupying many days in completion. The strawberry-growers of the Aberdeen and other northern districts may learn, from the annexed extracts from the official reports on the growth of the Florida trade, with what readiness they could reach the metropolitan markets with their late ripe fruits after the glut from the southern orchards has passed away and prices rule high.

The report of Mr Columbus Drew, United States Treasury Expert, Jacksonville, Florida, on the internal commerce of the United States, 1886, states:—

"The fruit industry—the growing of oranges and other citrous fruits—began to absorb the attention of landowners, the early product reaching a few thousand boxes, until, gradually and successfully increasing season after season, it reached 1,000,000 boxes of oranges in 1884-85, according to some estimates. This immense crop had produced its effect upon modes of transportation. Its movement enlisted capital, and freights became a large item of receipt and expenditure in the State. Refrigerating cars were introduced. Improvements in modes of transportation were objects upon which the best intelligence was concentrated.

"The vegetable crop followed or accompanied the orange crop, and this has reached a shipment of hundreds of thousands of crates. The destination of these crops has been mainly direct north and west by refrigerating cars. By rail nearly two-thirds of the crops have been sent to northern and eastern cities. One-third has been sent by rail to the great western markets, *viâ* the Waycross railroad, the Georgia Central, and from Pensacola."—P. 408.

Statement of Mr A. E. Dicker, agent for C. S. Durling of New York:—

"I am in the employ of C. S. Durling of New York. He operates largely in strawberries here and at adjacent points. During the season that has just closed he had four refrigerator cars employed in the transportation of berries. The season just passed is the third season that I have managed his strawberry shipping interest in this State. I have forwarded for him this season about 130,000 quarts of berries. The points that contributed to this aggregate were Hammock Ridge, Gainesville, Lawtey, Highland, Webster, Starke, Archer, Orange Lake and Manville, the great bulk of the berries being loaded at the three first points. I estimate that three-fourths of all the berries shipped from this State found their way into New York City.

"Some parties here have received a net return from Mr Durling of over $400 per acre, but the average net proceeds of sales will not exceed $250 per acre.

"That Mr Pillow has established a large business, occupies a large space for shipping in the buildings of the Waycross Railroad Company, ships directly to the trains large numbers of the latest refrigerating chests, and operates exclusively through the strawberry season, receiving back from New York and reloading his chests, would indicate that he must do an extensive business."—Pp. 417, 418.

The profitable results that have been brought within reach of the Pacific Coast and the thinly populated prairies are shown by the report of automatic refrigerator car:—

"Car Z. 1000, used for test purposes, has made several trips with results as stated below.

"On June 9th, she left Chicago for Cincinnati, loaded with butter, cheese, and eggs, 2 tons of ice being placed in the tanks. Upon arrival there, the product was in first-class shape, less than half a ton of ice being consumed.

"At Jacksonville, car was loaded June 29th with fruit for Minneapolis, arriving there July 10th. Two tons of ice were consumed on this trip.

"On July 21st the car started from St Paul with load of dressed beef from Minnesota Packing and Provision Company, for Kingston, New York, where it arrived on 28th. Three tons of ice placed in tanks at St Paul, 1400 lb. at Chicago, and 300 lb. at Frankfort, New York, the tanks being full upon arrival at destination, thus consumption of ice *en route* from St Paul to Kingston was but 2200 lb., and in the words of the consignees themselves, 'It is the best beef we have ever received.'

"Car returned empty to Chicago, where it was loaded with furniture (it being perfectly dry) for Kansas City, there it was iced and loaded with supplies for the eating-houses on the Santa Fe. Left Kansas City, August 24th, 8 P.M. Car opened to unload supplies at following stations, with temperature as stated:—

Newton,	Kansas,	Temperature	in car	45°
Hutchinson,	"	"	"	43°
Kinsley,	"	"	"	43°
Coolidge,	"	"	"	45°
La Junta,	N. Mexico,	"	"	46°
Raton,	"	"	"	45°
Las Vegas,	"	"	"	43°
Coolidge,	"	"	"	43°
Winslow,	"	"	"	46°
Williams,	"	"	"	46°
The Needles,	California,	"	"	39°
Barstow,	"	"	"	52°
San Bernardino,	"	"	"	55°

Ice used.

Kansas City	2 tons.
Florence	500 lb.
Raton	300 "
Williams	1500 "

"Between Coolidge, Kansas, and San Bernardino, the temperature ranged from 90° to 110° in the shade. Time, eight days, from Kansas City to San Bernardino.

"At Barstow the car laid over for ten hours in the sun during the hottest part of the day. Temperature at noon, 110° in the shade.

"The last lot of supplies delivered at San Bernardino in best of condition.

Return Trip.

"Car loaded at Santa Anna, September 14, with 1063 crates Muscat grapes for Chicago.

"Iced at—

	lb.
Santa Anna	2000
San Bernardino	900
Albuquerque	2000
Coolidge, Kansas	1000

"Temperature, Santa Anna, outside, 100°; in car, 55°. Delayed at San Bernardino from 6 A.M. to 6 A.H. Temperature at The Needles, 110° in the shade. Car opened at Coolidge, N. M., temperature, 46°. Delayed at Argentine from 9 A.M. till 3 P.M.; temperature outside, 94°. Arrived at Chicago, August 24, 2.30 A.M. Car opened same day at 9 A.M.; temperature inside, 55°. Grapes in excellent condition, time ten days from Santa Anna to Chicago."

But it is not alone in meat and fruit that the refrigerator car has proved useful to producers, for the fishing industries of the Canadian lakes and the rivers of British Columbia have also benefited by refrigeration and refrigerator cars, and by their means regularly supply the markets of New York, Boston, Baltimore, Philadelphia, and other cities, daily throughout the year, with fresh fish of all kinds, that possesses the characteristic feature of always being in the best possible condition, owing to its having been caught when in season and at once frozen and placed in properly constructed stores, where it remains until required for despatch to the American markets.

The facilities that refrigerator cars offer for the transport of fresh fish is shown by the report of the Hon. J. W. Taylor, United States Consul at Winnipeg, upon the exports from Central British America to the United States for 1888, which were as follows:—

	lb.
From Winnipeg	1,312,060
" Port Arthur	565,126
Total	1,877,186

or about 838 tons—the fish consisting of white fish, pickerel, jackfish, tullibee, sturgeon, perch, and catfish. The distribution of the exportation being to Detroit, Buffalo, Chicago, St Paul, Minneapolis, Omaha, and Kansas City."

The annual report of the Department of Fisheries for the Dominion of Canada, for the year 1888, p. 32, appendix, states:—

"White fish were reported to be so plentiful in Lake Erie last year, that the fishermen scarcely knew what to do with them. Seven hundred and fifty tons (1,500,000 lb.) were frozen for shipment by a single firm in Huron, Ohio!"

While profitable work like this is being done in the remote regions of the Wild West, our Highland fishermen are compelled to stand by listless, and see the enormous shoals of fish that visit their coast and harbours come and go, without having the efficient means of transporting, in a fresh condition, to the adjacent centres of consumption, at a reasonable rate, any of the fish they might secure, which would afford them remunerative employment, and furnish material additions to the food-supply of the people.

A notable instance may be cited of the readiness with which this particular trade could be carried out, if the effort to establish it was once made by the fishermen of the North. At the market of the Indian and Colonial Exhibition held at South Kensington in 1886, the Canadian Government exhibited, in a refrigerator, a varied collection of fish from the Dominion waters, that had been caught and frozen about six months before the Exhibition opened. The refrigerator was fitted with a double glass front, so that the fish were continuously on view, and they elicited a large amount of interesting attention from the visitors. The refrigerator, which was to all intents and purposes a stationary car, was charged daily with a supply of crushed ice and salt, in order to maintain the even cold temperature, which was successfully effected. Upon the termination of the Exhibition, it was determined to distribute the fish in such a way as would elicit the widest expression of opinion as to the condition it was in. This was done by giving a dinner to 124 noblemen and gentlemen, in the Exhibition on the closing night, and distributing the remainder of the fish in many directions, where it would be thoroughly tested, by being dealt with for domestic purposes in the ordinary way that fish is cooked in private families of various characters. The result was most gratifying in every way. The guests at the dinner, as well as the private recipients, pronounced the fish as equal to fresh-caught fish in every respect.

It is not too much to say that, if such results can be secured in a territory where the temperature reaches a tropical heat for a considerable portion of the year, not only no difficulty presents itself for the adoption of a similar course of procedure with ourselves, but the fact remains, that by reason of our much milder climate, the cost incidental to its manipulation and practice would be greatly reduced, and the results acquired at a considerably less expenditure.

By this experience of what has been achieved abroad, it may be taken for granted that whenever a regular service of refrigerator cars is provided on our railways, a demand will spring up for the use of the facilities they offer, new sources of traffic being thus created for home railways, with the effect that the farmers, graziers, and fishermen of the remote districts in the North of Scotland will be brought into a close and direct communication with the markets of the midland and metropolitan districts, when communities of our own kingdom, at present unknown to each other, will be brought into a commercial relationship of a mutually beneficial character to the producers and consumers of both.

REFRIGERATOR CARS: THEIR CONSTRUCTION AND MODE OF WORKING.

In determining the construction of the best refrigerator trucks for home uses, numerous features incidental to the requirements of a perishable food traffic have to be taken into consideration; for although their general principle may be the same, the incidental details vary in a marked degree, inasmuch as while the general principle is for the car to be furnished with a continuous supply of pure cold air, the details will be found to arise in consequence of the varying temperature in which different articles of produce require to be conveyed in order to preserve their natural flavour and characteristics intact. Thus fish packed in ground ice requires a temperature of 32° Fahrenheit; while fresh meat, poultry, or game will keep upwards of twelve days at a temperature of 36° to 38°, and even a much longer time if the temperature is reduced 2°, 4°, or more; and fruit, if just approaching ripeness, will travel and keep well at 40°; while eggs and butter will keep perfectly fresh for one or two months at temperatures ranging from 42° to 45°.

Thus it will be seen that, as the various commodities require different temperatures, therefore one of the most important elements for consideration is the acquirement of the knowledge by which the particular temperatures for the produce to be carried may be obtained at the least possible cost.

The condition of cold, like that of heat, can only be produced by the expenditure of fuel in some form, and requires a perfectly insulated chamber to retain it without loss. It thus becomes an essential matter to determine not only the best means for the economical production of a cold atmosphere, but the effective retention of it when once secured; for by a very small amount of neglect or inattention, either in the construction of a car or its subsequent working, a considerable quantity of cold can be speedily lost that may entail an expenditure of material to reproduce it.

Then, again, the air in the car requires to be not only cool and dry, but fresh and pure, otherwise the commodities in course of transit will become tainted and mouldy. To ensure this result, the construction of the car should provide for its effective ventilation without the outer atmosphere being permitted to recklessly enter the car, or the cold air within the car to escape. The car should also be provided with means by which all air upon entering is effectively filtered and deprived of such germs as it may contain, while at the same time, by it being drawn or directed into contact with a cool medium, the heat and moisture should be eliminated from it.

In connection with these points the nature of the produce to be conveyed requires to be taken into calculation, and its condition at the time of loading to be carefully noted. Serious losses were sustained by American consignors in the early days of refrigerator cars for want of knowledge how to handle produce, or carelessness in practice. This will be understood from the fact that all commodities possess a latent heat to a greater or less extent, which further varies in accordance with surrounding circumstances and conditions. Thus fresh meat, immediately after slaughter, contains a considerable amount of animal heat, which it gradually loses until it reaches the condition of the normal temperature of the chamber in which the carcasses are retained. Should meat be placed in a very low temperature immediately after the slaughter, the outer surface will cool off too rapidly, dry up, and become crusted, sealing up the meat, and preventing the animal heat, with its peculiar effluvia, from escaping—the effect being that it becomes putrid in the meat, which, upon being withdrawn from the low temperature into one of a higher degree, will too rapidly decompose. This condition of things need not take place, and will be found to present itself in the exact ratio to the treatment the meat receives in its manipulation; for, if immediately after slaughter it is removed to a cool chamber, in which a dry atmosphere is maintained at about 40° Fahrenheit, and it is allowed to remain there for from twenty-four to thirty hours, the meat will "set"—that is, the animal heat will be eliminated, and the meat become firm and dry to handle. If, then, it be removed to another chamber or refrigerator car, where the temperature is maintained at from 34° to 37°, the meat will remain in prime fresh order for one month—always providing the air is perfectly dry; or, if it is required to be kept longer than that time, it may be done by reducing the temperature, according to the time required, down to freezing-point; but if a longer time is required than one month, it is safer to go below 32°, and thoroughly freeze the meat, unless a perfectly dry atmosphere can be ensured in which to retain it. But by freezing meat its commercial value is reduced, and if it is kept in a dry atmosphere too long it will lose weight.

The most complete evidence that has come under my personal observation of the length of time which meat will keep fresh in a dry atmosphere, without being frozen, was furnished by the shipment of a large quantity of mutton and beef from the river Plate to Rouen by the French steamer Frigorifique in 1877. The consignment exceeded 100 tons in quantity, and 104 days were occupied, from the commencement of the slaughter and loading at Campana, until the arrival of the vessel at Rouen. During this time the temperature of the cold chamber was maintained at about 33°. On one occasion it went below freezing-point for a short time, and on another it went up to 38° for a day, by reason of a breakdown in the machinery; but the meat reached France in good condition, although the dry atmosphere in which it was kept resulted in absorbing the moisture from the meat to a remarkable extent—the shrinkage in weight being fully 30 per cent, a circumstance that affected the appearance of the meat, but not its quality, for on being cooked it absorbed water, became remarkably juicy, and full of gravy. The Frigorifique shipment of fresh meat was the first that crossed the tropics to Europe, and to this date is the only one that has reached it in an unfrozen condition. The extent of the shipment and duration of the voyage furnish unique evidence of what may be effected with dry air without freezing.

Fruit contains a considerable amount of latent heat and moisture, which it gradually throws off while in good condition, but both of which materially increase if fermentation is allowed to set.

From an economical point of view it is absolutely essential that all produce intended for transmission by means of refrigerator cars should be cooled down before being loaded in stationary cool chambers to the temperature at which they will keep, and thus relieve the car from the cost of carrying the material for producing the extra cold in transit for removing the latent heat, which may be done more effectually and economically before the journey had commenced.

It cannot be too thoroughly understood that there is a marked difference in the cost of stationary refrigeration and refrigeration in transit, owing to the cost of hauling the cooling medium, in whatever form it may be, whether in shape of ice or refrigerating mixtures, inasmuch as it is the initial stages in refrigeration that are the most costly. For example, to take five tons of produce that retains a temperature of 60° and reduce it to that of 35°, means the removal of several thousand units of heat that requires a considerable expenditure of ice or its equivalent in cold air; but to take five tons of produce which has been reduced to 35°, and to maintain it at that temperature in a perfectly insulated chamber, requires but a nominal expenditure of ice or its equivalent in cold air. The difference in the two systems means not only the extra cost of providing the ice or refrigerant at isolated places in transit, but the cost of conveying the additional quantity of material throughout the trip, which, as it runs into a question of tons on a journey, becomes a serious consideration at the present rates charged upon our railways.

The number of patents taken out in America in connection with refrigerator cars are remarkably large, and they apply not only to the construction of the cars as a whole, but to various detailed parts. It is unnecessary to dilate at any length upon the details of these, for the reason that the nature of home traffic differs so materially from that of America; therefore, more beneficial results may be derived by pointing out the general character of the refrigerator cars that are in use in America, and to what extent they should be varied to make them suitable for the purposes of home traffic and trade.

Fig. 1 shows an ordinary American refrigerator car, whose dimensions are about 34 feet long, 8 feet 9 inches wide, and 8 feet 6 inches high. Its undercarriage is constructed with bogie wheels, and, although it will carry more, its recognised load is 20,000 lb., that being the minimum quantity upon American railroads to entitle the sender to the reduced car-load rate. If the quantity does not reach that weight, the higher rate has to be paid.

Fig. 2 shows the structure of the body of the car. These are usually composed of three separate spaces, which are invariably occupied with non-conducting substances, so as to produce the most effective insulation at the least cost, and in the lightest manner possible. To construct the three divisions, requires four distinct timber coverings, which must of necessity be closely fitted, so as to make each of them air-tight. To ensure their being so, it is customary to paste two or more coverings of thick brown paper on to each of the boardings (care being taken to effectually close all joints and corners) of the three additional timber-coverings to that of the ordinary body of the car, materially increasing its weight, which is a marked item of consideration with railway companies, who have to provide the engine-power to haul the cars; in addition to which there is an iron tank or receptacle for the ice, both of

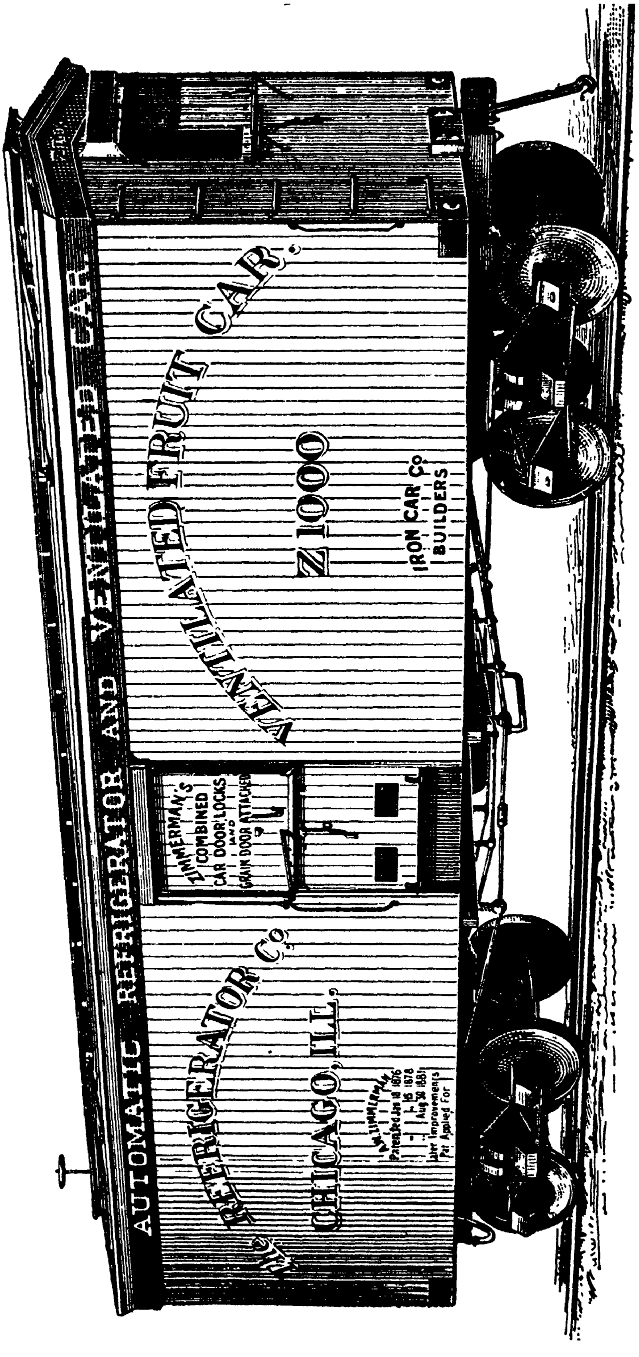
AUTOMATIC REFRIGERATOR AND VENTILATED CAR
THE REFRIGERATOR Co.
CHICAGO, ILL.
A. M. ZIMMERMAN
Patented Jan 18 1876
" " 15 1878
" Aug 30 1881
Later Improvements
Pat Applied For
ZIMMERMAN'S
COMBINED
CAR DOOR LOCKS
AND
GRAIN DOOR ATTACHED
VENTILATED FRUIT CAR.
Z 1000
IRON CAR Co
BUILDERS

Fig. 1.

which add to the weight of the car. Different materials are used for insulation, according to the experience and opinions of the several patentees—felt, hair, charcoal, paper, dead air, and other substances are utilised, each and all of which add to the weight in a greater or lesser degree. Valves, openings, drip-pipes, and numerous other contrivances are embodied in the construction of the vehicles, that need not necessarily be referred to, for the simple reason that the whole construction of the car is too complex for any trade the United Kingdom can furnish.

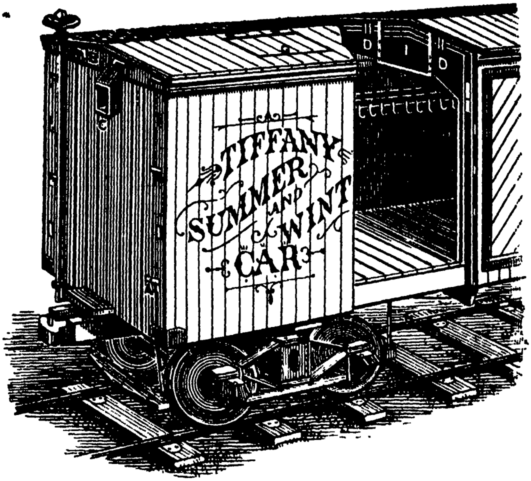

Fig. 2.

Journeys on American railways frequently exceed 2000 miles in length, occupy eight to nine days in completion, while the temperature will range from 90° to 100°, which the car has to reduce to 35°, a reduction of 55° to 65° over a long interval. At the same time, the loads are made up at large centres of production, that go direct to centres of consumption, and large as the cars are, they may readily be filled. With home traffic the whole thing is reversed: the temperature seldom exceeds 55° in the north, and 60° in the south; the journey from extreme points, even by goods train, being worked in twenty-four to thirty-six hours, necessitating a reduction of but from 15° to 20° for a short time, while the centres of production and consumption are largely spread over a comparatively small area. The expensively constructed and over-weighted American cars are by no means necessary to comply with the requirements of home traffic, which is more suitable for a car of much lighter build, which would not cost anything like so much as the

American to construct in the first instance, or to work subsequently.

There are points of departure, where whole truck-loads of a special commodity could be readily provided—such as Aberdeen for its meat traffic, and Wick for its herrings in the season.

For these the full-sized car could be used where they would be consigned to a given destination; but for the other places that could provide but one or two tons of meat or fish, or even a less quantity of poultry, eggs, or butter, the large cars should be divided into five compartments, any one of which might be opened to permit of being loaded and unloaded without causing the warm air to permeate the whole car. Cars built in this way would not need more than one ice receptacle, as valves could be fitted to each compartment which would be opened automatically on the closing of the door, and closed automatically upon the door being opened.

The body of the car, instead of being composed of three spaces requiring four distinct boardings, need not be more than the present framing carefully boarded on both sides, the spaces being filled with granulated cork, dead air, or some such suitable filling, both non-conductive, remarkably light, and inexpensive, the boarding being effectually covered with two or three thicknesses of brown paper, or one of mill-board would be perfectly air-tight. The framing of ordinary railway trucks is three inches in thickness, which could be filled up with granulated cork, dead air, or other suitable material, the boarding on both sides with the paper or mill-board together, forming a solid non-conducting wall from 4¼ to 4½ inches thick, which would furnish an insulated truck of a most effective character, inexpensive, but at the same time most durable, and fully equal to all requirements of home producers.

The nature of the cooling medium to be employed in the subsequent working of the truck is an important item to consider. Ice is easily handled, but is wasteful and heavy, and not always procurable; however, it is well understood that with ice a definite result can always be ensured. Ice, however, may be used in bulk, or it may be used in connection with salt, by which a very much lower temperature may be obtained. It is with little zinc tanks of ice and salt that the small fish-cars of Canada are refrigerated in order to convey their loads of fresh fish to the American markets; but these cars are of quite a different construction from the American meat-cars, being about six feet long, five feet wide, and five feet high: they form a solid case on four wheels, and are run on to platform railway trucks; each one holds from one ton to one ton and a half of fish, and six of them go on to a railway truck. A truck of similar capacity will be found to be remarkably useful in the home trade for fish, meat, fruit, or dairy produce; but our railway men will have to be educated up to the system of charging and working them, or a temperature below freezing produced, which would injure the contents.

Two means present themselves for the utilisation in connection with the refrigeration of railway trucks: one is by means of refrigerants, and the other by a cold-producing machine that could be attached to a train and keep all the cars charged with cold air. Both of these systems would go far towards reducing the weight to be carried, and consequently the cost of transit.

Where a system has not been practically worked, it is not possible to definitely state what the actual commercial outcome of its practice will be; but scientific knowledge will furnish the information that by following a certain course a particular result is assured, and ordinary experience teaches the possibility of the advantages obtainable being profitable. Thus we know that there are numerous chemical products which, if brought into contact in definite proportions, will produce a given degree of cold, without either ice or snow. Some with snow added will produce a most intense cold; and in this direction will most likely be found a key by which a refrigerator car service could be most economically worked from the north of Scotland, and beneficial results obtained. Snow may be readily procured in the Highlands during the winter, and stored until required for use, when, by mixing it with common salt, cars may be effectively charged at a nominal cost with a refrigerant that is wonderfully light in weight compared with the quantity of cold produced.

To utilise a cold-air machine that would charge and keep cool a train-load of trucks, is a means by which a refrigerating service could be readily, well, and effectively worked, but it necessitates organisation. The machine, placed in the compartment of a carriage in front of the train, could be worked by steam from the engines by an independent boiler, or by connection with the axle in accordance with the power required. The refrigerator carriages, connected with each other by a six-inch spiral tube similar to those with air brakes, would be placed in communication with the compartment into which the engine was discharging cold air, while a fan in the end carriage, worked by the axle, would exhaust the air from it, and create a continuous cold current from the engine that would permeate the whole of the carriages of the train.

From this it will be seen that the establishment of a refrigerator car service in America has been productive of the greatest benefits to producers there; that the probability of equally beneficial results being attained by our own farmers and fishermen from the adoption of a similar course is remarkably strong; and that the means being found for the formation of such an organisation as will bring the benefits named within reach of all districts connected with the existing railway system, will tend to create a new traffic, and largely add to the available supplies of home-grown food.

CATTLE INSURANCE IN THE RHINS OF GALLOWAY.

By W. H. Ralston, Culmore, Stranraer.

At this time, when pleuro-pneumonia is so prevalent in Scotland, a short paper on the mutual insurance amongst the farmers of the Rhins of Galloway against the ravages of this disease and cattle-plague may be interesting to the members of the Highland and Agricultural Society.

The system of mutual insurance of stock seems to have had a hold among the Rhin farmers for some time—probably the fact of it being entirely a dairying district (dairy stocks having usually a great percentage of deaths) may in some measure account for this—as over twenty years ago we find an insurance society, known as the "Lochans Mutual Cattle Insurance Society," in operation within a given district, whose policies covered deaths of all descriptions among cattle. The office-bearers were chosen from, and the society managed by, the farmers themselves. The premium charged was necessarily high. From what we can learn, it ranged from 2s. 6d. to 4s. per head—evidently depending on the rate of mortality for the year. The method pursued was to have all the insurers' stocks valued at Martinmas in each year, by valuators appointed from among the members for the purpose, who had to be notified when any additional animals were purchased, in order to have them also valued; and when an animal was found ailing, a member of committee was sent for, who saw whether proper means had been taken towards its recovery, and who, in case of death, granted a certificate for production to the treasurer when compensation was sought.

It was ultimately found that a few of the larger farms, carrying from eighty to one hundred and twenty cows, had a greater proportion of deaths than those under sixty cows or so, and were thus receiving more than their share of benefit. This, together with the heavy premium, was the cause of the withdrawal of a number of the members and the break up of the society. In connection with this society, and showing the benefit to be derived from insurance, one case of a small stock of from twenty-five to thirty cows is mentioned where not a single death of any kind had occurred for years, in which eventually pleuro-pneumonia broke out, and every animal died, or was slaughtered to prevent the disease spreading, the usual compensation being paid. The society was thus the means of preventing further outbreaks, while compensating the farmer in a great measure for the loss of his stock, who must otherwise have been a very heavy loser.

A number of outbreaks of pleuro took place about this time (1868-1871), all of which were summarily dealt with. In every case the stocks were bought up and slaughtered, the healthy carcasses sent to market, and the affected ones buried; while the sum required for compensation was raised partly by voluntary subscription and partly by the local authority.

It began to be seen that a society insuring against losses by pleuro, cattle-plague, and other deadly contagious diseases, would be likely to succeed, as it would take the place of voluntary subscriptions in dealing with outbreaks, and each stock-keeper would then be on an equal footing in providing for losses, besides having the right to compensation in case of loss himself. Consequently, in January 1872 a public meeting was called to consider the question, at which a resolution was passed forming what is now known as the "Rhins of Galloway Cattle Insurance Company (Limited)." It must be borne in mind that at this time there was no provision by the Privy Council for dealing with pleuro by slaughter and compensation, the Act for this being passed in 1878. Had the same rules been in force in 1872 as are now, it is probable this company might not have been formed; but the members being now fully alive to its benefit, it is still carried on, particularly as there is no security that the rules at present in force will be continued for any length of time.

The objects of the company, as set forth in the "Memorandum and Articles of Association" appended hereto, are to "limit the ravages of diseases of cattle, and to mitigate their pressure on individuals." In order to accomplish this, it was agreed that "the annual payments from members for insurance and voluntary subscriptions shall annually be accumulated and invested by the directors of the company as a fund primarily liable for losses, until it shall amount to the sum of £5000, and until that sum is accumulated no dividend shall be declared." The rate payable by members was 1s. per head annually for every animal insured. The landlords also at first, until the accumulation of the £5000, subscribed at the rate of 2s. per £100 of rental. The sum aimed at was reached in 1884.

The compensation to be paid was at first limited to three-fourths the value of the animals dying; but after 1878, when local authorities were bound to deal with the disease in a somewhat similar way, the compensation for all animals dying by disease or slaughtered was increased to full value—*i.e.*, the difference between what was paid by the local authority and full value was made up by the company.

At the formation of the company it was universally admitted—in fact, proved by actual experience—although not embodied in the rules, that the only way to free the district of pleuro was by stamping it out; and this has been adhered to with unqualified success, all outbreaks having been thus dealt with, with the result that the disease has never once spread beyond the farm where the original outbreak took place, and this among a class of stock considered peculiarly liable to attack by this disease. As examples of what is done by the company, in 1877 two outbreaks of pleuro occurred. In one case the stock was insured, and was dealt with according to the rules of the company, the sum payable by the company—after deducting the sale of the unaffected carcasses and the sums paid by the local authority—being £160, 6s. In the other case the stock was not insured, but the tenants in the parish where the outbreak occurred raised a voluntary assessment of 1½d. per £1 on their rental, bought up the stock, and had it slaughtered, the insurance company, under a special resolution, repaying its members their assessment, which amounted to £74, 15s. 1d.

As before stated, the stipulated sum of £5000 having accumulated in 1884, it was resolved to collect nothing further from members in the meantime, and the capital being well invested, the sum continued to accumulate until February 1888, when it had reached over £6000. It was then resolved to divide the half of the funds in the form of a bonus to the members, according to a scheme of division which was drawn up and approved of by the company. The calculations necessary for this scheme of division, which were most intricate, were successfully made by the present secretary to the company, Mr J. M. Rankin, P.-F. Previous to this the offices of secretary and treasurer were honorary, and were filled by members of the company in turn.

As there was now no such immediate need for a rest fund, and the sum of £3000 being in hand, it was resolved to reduce the annual premium from 1s. to 6d. per head for every animal insured, as an inducement to farmers who had not yet become members to do so, and thus widen the scope of the company for good.

There is a feeling abroad among a number of the members that the company ought also to cover deaths from tuberculosis, as no disease among milk stock causes such an annual mortality; while it is held by others that the premium which would be required to cover it in addition would be prohibitive. But as the subject has not been as yet formally before the company, there is no official opinion by which to judge what will ultimately be determined upon.

The success of this insurance company tends to show how much can be done in districts or counties by combination for mutual protection against disease. Here was a sum of £5000 accumulated in a dozen years by the small annual payment of 1s. per head for each animal insured, while at the same time covering and providing for loss from outbreaks of disease. Does it not seem to many to be possible to extend the principle — notwithstanding the present Order in Council — to those districts which have suffered so much in the past from pleuro, and in fact over the whole of Scotland? Should this be done, and the outbreaks be as firmly dealt with as they have been in Wigtownshire, together with the local authorities keeping a strong hand on the movement of cattle, we should hope soon to see the country free from the terrible scourge of pleuro.

RHINS OF GALLOWAY CATTLE INSURANCE COMPANY, LIMITED.

I.—MEMORANDUM OF ASSOCIATION.

1st, The name of the company is "The Rhins of Galloway Cattle Insurance Company, Limited."

2d, The registered office of the company will be situated in Scotland.

3d, The objects for which the company is established are to limit the ravages of diseases of cattle, and to mitigate their pressure on individuals; and those objects embrace mutual insurance against death by rinderpest and pleuro-pneumonia, and the doing all such other things as are incidental or conducive to the attainment of the above objects.

4th, Every member of the company undertakes to contribute to the assets of the company in the event of the same being wound up during the time that he is a member, or within six months afterwards, for payment of the debts and liabilities of the company contracted before the time at which he ceases to be a member, and the costs, charges, and expenses of winding up the same, and for the adjustment of the rights of the contributories amongst themselves, such amount as may be required, not exceeding one pound sterling for every head of dairy cattle insured by him under class first in number 7 of the articles of association, and 13s. 4d. for every head of cattle insured under class second in said article.

Names, Addresses, and Descriptions of Subscribers.

II.—ARTICLES OF ASSOCIATION.

1. The company, for the purpose of registration, is declared to consist of two hundred members.

2. The directors hereinafter mentioned may, whenever the business of the association requires it, register an increase of members.

3. Any person desiring to insure with the company shall lodge with the secretary a proposal containing an engagement to abide by these rules, with an inventory of his cattle, on forms to be issued by the secretary; and on the same being accepted by the directors, he shall pay 2s. 6d. of entry money, and a rate of sixpence per head on all cattle owned or possessed by him above one year old, payable yearly on 22d November, which is the beginning of the financial year; and any member entering during the currency of the year shall pay as for the whole year. The first payment of the new rate of sixpence per head shall be made on 22d November next.

4. The proposal shall lie for twenty-one days, after which it will be considered, and if approved and accepted of by the directors, a certificate, signed by two or more directors, shall be issued on payment of entry money and rates, and shall thereafter be in force till the end of the financial or insurance year then current. The directors may decline any proposal without assigning reason therefor. The insured shall in all cases forfeit his insurance, deposits, and right in the funds, by acting as a cattle-dealer; and a person shall be esteemed a cattle-dealer who, in the judgment of the directors, buys and sells for profit from time to time cattle, other than for the *bona fide* use of his own farm.

5. The whole cattle belonging to a member must be included in the insurance, except cast cows to be replaced by others, and which, in the option of the insurer, need not be included. In the event of any cattle being added to the insurer's stock, he must declare them, and pay the deposit for the additional number. If rinderpest or pleuro-pneumonia shall appear in Wigtownshire, no person shall be thereafter admitted to the benefits of the insurance while any stock therein is known to be affected by either of the above diseases.

6. In the event of the annual rates payable by a member as aforesaid remaining unpaid for six months after the 22d November in any year, payment shall not thereafter be accepted (unless as hereinafter provided for) and the insurance of the cattle of such a member shall cease and determine, and he shall forfeit all benefit and claims in respect thereof, excepting always such benefit or claims as shall have become due to him prior to said 22d November in any year—the benefits of the said insurance and the claims of members subsisting only so long as the said annual rates are duly paid as aforesaid. Provided that it shall be in the power of the directors, in their discretion and if they see fit, upon written application being made by such defaulting member within three months after the elapse of the said six months to accept payment of such arrears of rates, and upon such payment the insurance of such member and his rights thereunder shall be restored in the same way as if he had duly paid the annual rates as aforesaid. Members shall continue liable for their respective shares of losses for six months after they have ceased to have interest under this rule.

7. Cattle for the purpose of insurance shall be classified and valued as follows, viz.:—

Class I. Dairy cows and queys in calf.
Class II. Bulls, oxen, and heifers of one year old and upwards, and, in the option of the insurer, calves.

The value of each animal insured shall, for the purpose of this insurance, be held not to exceed sixteen pounds sterling; but if, during the life or after the death of any animals insured, the person or persons appointed to examine them in terms of article 14 shall certify that such animals were, when in health, of less value than £16 each, their value shall be held to be the sum fixed by the person or persons so to be appointed.

8. Members who are entitled to the benefit of the insurance provided for in these articles shall be allowed the value, subject to the limitation in article 7, of each animal which shall be certified, to the satisfaction of the

directors by the person or persons deputed by them for that purpose, to have died of rinderpest or pleuro, or to have been killed under the provisions of the law, or with approval of the directors, and to have been buried in its skin at least five feet under the ground immediately after death. But declaring always that such compensation shall be subject to the deduction of any compensation which has been received by or is payable to such members from the local authority or any other public source, for or in respect of the same animals—the amount payable by the company in such cases being only such sums as, along with any compensation so received or payable, shall make up the full compensation stipulated in these articles.

9. The directors shall have power to allow any actual loss which may be caused by destroying any healthy animal by their order, with the owner's consent, in order to prevent the spread of infection. They may also, by general or special order, require insured stock, when attacked, or when it has been exposed to risk of infection, to be killed, for which compensation shall be allowed, and they may require any insured animal, when dead, to be buried in manner mentioned in article 8.

10. No member insuring shall be responsible, under any circumstances, for a greater amount than one pound per head of the number of the stock insured by him, nor shall members be responsible for one another; and no liability shall attach to any persons who have hitherto contributed or who may hereafter contribute voluntarily to the funds of the company.

11. On any animal showing any symptom of illness, the insurer shall be bound instantly to separate the same, and to keep it separate from his healthy stock, and to give notice within twenty-four hours to the nearest director, and within forty-eight hours to the secretary. The insurer shall use his best endeavours to preserve his stock, as if it had not been insured, and shall take care that they have proper treatment, and shall pay the expense of treatment.

12. Any member who shall knowingly, or under circumstances which, in the judgment of the directors, evince an unjustifiable want of caution, introduce cattle from any infected stock or locality, or any diseased animal, or suffer his stock to mix with diseased stock or put them into any infected or tainted building or place, shall forfeit his insurance, deposits, and payments.

13. Fraud, wilful misstatements, culpable neglect, or the failure to fulfil any of these conditions, or any attempt to impose upon or deceive the company, shall render the insurance void, and the insurer shall thereby forfeit all claims to compensation as well as all deposits and payments made by him.

14. All inspections or valuations shall be made by such person or persons as may be appointed by the directors for that purpose, and their reports, both as to value (subject to art. 7) and as to the cause of death, shall be final and binding on all parties. The directors and their officers are to be at liberty at all times, on reasonable cause, to inspect the stock and premises of the insurer, and the insurer shall supply any information respecting the same which the directors or their officers may require.

15. The decisions of the directors may be appealed against to the next general meeting of the members by a written notice given to the secretary at least ten clear days before the general meeting. But all decisions in questions with or among members, in regard to the insurance or their liabilities under these articles, shall, if not so appealed against, or if affirmed, or as altered by the general meeting, be final and conclusive, and not subject to question or examination on behalf of any member in any court of law.

16. Whereas the accumulated funds of the company now exceed £5000, and it has been resolved to divide amongst the members one half of the accumulated funds with interest as at Whitsunday 1887, according to

scheme made up and approved of by the company,—the remaining half and future rates and income shall be accumulated and invested by the directors as a fund primarily liable for losses until it shall amount to £5000, and until that sum is accumulated no dividend shall be declared or division made. When the accumulated funds amount to the above sum of £5000, the same shall be dealt with as may be resolved by the company.

17. In the event of any member dying, leaving his farm, or becoming bankrupt (but under no other circumstances), he or his representatives shall be entitled to receive back the amount contributed by him under deduction of his proportion of any losses which may have been paid during his membership.

18. In the event of a loss becoming payable to a member who has not contributed from the beginning, there shall be deducted from the sum so payable an amount equivalent to what would have been the amount of his contributions had he contributed from the first, at the same rate as his actual payments; and the sum so deducted shall be placed to the credit of such member in the state of funds.

19. The directors are authorised, in the event of any circumstances arising not at present anticipated, to take any steps necessary for the interest of the company, but they shall, as soon as possible, call a meeting of the members, should any serious emergency occur. The directors shall also have power to appoint committees of their own number, and also parish committees of members, and to make general bye-laws, for carrying on the business of the company.

20. The directors are twelve in number, who continue in office till the next general meeting of the company, when the first half of them retire, and six are elected in their place,—the remaining six retaining office for another year, when they in turn retire; and thereafter yearly in the rotation and order above mentioned. All retiring directors shall be eligible for re-election.

21. The annual general meeting of the company shall be held in December in each year.

STRANRAER, *3d and 24th February* 1888.

No......

PROPOSAL OF INSURANCE

BY

....

....

The stock proposed to be insured is on the farm of.......................... parish of.......................occupied by the insurer, and the number of animals to be insured under Class I. is.........and under Class II.......... being the whole number possessed by the insurer, except...........cast cattle.

TO THE DIRECTORS.

GENTLEMEN,—I propose to insure my cattle in accordance with the above, and if the proposal is accepted I engage to abide by the Articles of Association prefixed hereto.

Signature....................

Date.......................

No......

ACCEPTANCE BY DIRECTORS.

We,.......................Directors of the above company, having examined and approved of the above proposal, do hereby accept the same, and declare that the proposer above named, having paid the deposit, is entitled to the privileges of an insured member so long as the number of cattle insured remain on the above farm, subject to all the conditions in the Articles of Association of the company.

Signature of { ....
Directors { ....

Date......................

THE GROWTH OF TREES.

By William Somerville, D.Œc., B.Sc., F.R.S.E.

[Premium—*Ten Sovereigns.*]

In the following pages an attempt is made to lay before readers of the English language some results which have been obtained by foreign workers. Within recent years, more especially in Germany, investigations into questions affecting forestry and the growth of trees have been numerous, and the results valuable. While we are indebted to Professor Schlich for enriching our literature in sylvicultural matters, and bringing it in a measure up to date, and to Professor Marshall Ward for giving us a succinct account of some of the more important diseases of trees, there still remain many important points which have been practically untouched by English writers. One or two of these points are here discussed, and, in order to make them as clear as possible, some matter may be introduced which is familiar to most readers; still it is hoped that, on the whole, the article is not altogether without some practical value to foresters in this country.

Like all our more highly developed plants, a tree sends roots into the ground and branches into the air. Food from the soil is taken up by the former, and food from the air by the latter. The mineral food enters the tree in the form of a very weak solution in water by means of fine hair-like roots, which are present on the larger roots or rootlets, but only on that part, beginning, as a rule, about half an inch behind the apex, and extending back an inch or two. Farther from the point than this the root-hairs are all dead, and consequently incapable of taking any further part in the feeding of the tree.

The weak solution of raw plant-food, as found in ordinary soil stocked with trees, is chiefly influenced by two forces. There is the osmotic attraction of the living cells of the root-hairs tending to draw it into the plant, and there is the capillary attraction existing in the soil particles themselves which acts as a counter-force. The former force will prevail over the latter if the root-cells be in good working order, provided the solution of mineral salts in the soil is greatly weaker than the sap in the cells, and if the soil be sufficiently supplied with water to reduce the power of capillarity.

A continuous but very small stream of watery solution is, under these circumstances, and if the ground temperature be not too low, constantly flowing from the soil immediately in contact with the root-hairs into the latter, by which it is conveyed to the roots and thus into the higher parts of the tree. As the soil particles lying contiguous to the root-hairs are drained of their moisture, capillary attraction is set up in them, by which moisture is drawn from other particles lying more remote, and these again from others, and so the process continues on a sort of give-and-take principle.

Root-hairs cannot absorb food when the temperature of the soil, and therefore that of the water, is very low. For this reason the greatest absorption of water does not take place till well into summer, because the soil requires a long time to get heated up after the cold of winter; while, on the other hand, the temperature of the soil falls but slowly in autumn, and therefore root-growth and considerable absorption of water go on far into winter. Mohl, after many observations, came to the conclusion that complete winter rest of the roots only takes place in the case of conifers, and that the roots of all broad-leaved trees continue more or less active during the whole year.

Apart from individual peculiarities, it is largely owing to young trees having shallow roots, whose temperature is therefore soon raised in spring, that growth begins earlier in their case than in the case of old trees, where the roots often penetrate the soil to a great depth. But, on account of late frosts, early growth is often a very doubtful advantage, and many exotics which are tender in early life become quite hardy afterwards, simply because their roots are then so deep that dangerously early growth is prevented.

The solution of mineral food ascends the stem by a process which is not thoroughly understood, but the path which it pursues is now well known. It selects that part of the wood which lies nearest the outside of the stem, and, travelling upwards, feeders go off into all the branches and twigs, the water being at last, in great part, evaporated in the leaves. Part, however, is decomposed there to unite with the carbon obtained by the reduction of carbonic acid gas by the action of the chlorophyll working under the influence of sunlight, and the result of this union is a carbohydrate, either grape-sugar or starch. On account of starch being the material usually found in the guard-cells of the stomata, it is generally supposed that this is first formed, although there is not wanting evidence in support of the other view—namely, that grape-sugar is the primary product. As is well known, these two substances are very closely related, so that under the influence of certain plant-ferments starch is readily converted into grape-sugar, and *vice versa.* An important difference between these two bodies, at least so far as plant physiology is concerned, consists in grape-sugar being a diffusible substance, whereas starch, as such, cannot move from place to place in the plant. On the theory that grape-sugar is first formed in the guard-cells, some immediately goes away to supply food for the living cells, or to one or other of the storehouses for reserve plant-food, the rest being converted into starch, in which form it remains in the guard-cells till required in another part of the plant, when it again assumes the form of grape-sugar and passes out.

The course taken by the elaborated plant-food, in descending from the leaves, lies through the bast, which is situated not only outside the firm wood, but also external to a very thin layer of cells called the cambium. Some very simple experiments, which demonstrate the courses taken by the ascending and descending plant-food, may be performed without much trouble by any one. If a ring of what is popularly called bark be removed from a tree, at the height of a few feet from the ground, and if the stem below the point of removal be destitute of branches, no growth will take place below the ring after the first year, and the little that does then occur is not due either to ascending or descending sap, but to the consumption of reserve materials. Above the point of disunion of the bark, however, increase in thickness proceeds very much as if nothing had happened. This proves that the ascending flow is by way of the wood, and the descending one is through the part of the tree lying outside of the wood. It also shows that the upward flow does not support cambium activity, and is therefore not quite worthy of the name of plant-food, until it has undergone some change in the leaves. Growth in the upper part of the tree, under the circumstances indicated, may go on for many years, but will ultimately cease, because death of the alburnum will sooner or later occur, owing to the exposed part being decomposed under the action of minute fungi. This, however, is not always the cause of the death of the tree, for some trees, in the event of the outer wood being destroyed, have the power of conducting the upward stream through the innermost wood; but even in such a case, growth cannot very long go on. What usually puts an end to the existence of a ringed tree, is the death of the root-hairs, these being no longer nourished owing to the check given to the downward flow. That this is the case may be proved by selecting a tree with a forked stem, and ringing one of the limbs. The behaviour of the limb operated on, will be found to be the same as in the case already cited, with this difference, that growth will proceed for a much longer period. The limb which was not ringed will be able to send down nourishment enough to keep the roots in good health, which are thus able to continue sending up water and mineral matter to both limbs. In a case of this kind it is probably only death of the wood, at the point of rupture of the bark, which puts a stop to further growth.

In order to make the following remarks clear, we shall first look at the case of a single tree, which has all along stood perfectly isolated. If no disturbing causes have been at work, the stem of such a tree will be distinctly tapering and regularly clad with branches down to the ground. The shape of such a stem is due to several causes. In the first place, the lowest part has the results of more years of growth than any other part, and as the stem is followed up, these regularly decrease, until in the leading shoot we find nothing but the wood formed during the preceding season. But if cross-sections of the stem, taken at regular intervals, be examined, it will be found, by carefully measuring the same wood ring at various heights, that, as it is followed up, it undergoes a steady decrease in breadth. This has the effect of making the tree more decidedly conical year by year, for the diameter of the base is receiving greater annual augmentations than that of the parts nearer the summit. The explanation is that the flow of plant-food down the stem can supply nourishment to the cambium at the top, and have some remaining over at the point where the highest branches or twigs join. These add their contribution, and every branch farther down tends to increase the supply—in fact, the stream is always becoming richer—so that at last, after the lowest branches have joined the stem, the sap may be very much richer than in the upper parts of the tree, and thus the cambium-ring is able to work with more effect.

Let us now look at what becomes of the food which is not required to keep up the activity of the cambium.

When a tree occupies a good situation as regards soil and sun, and has a normal extent of leaf-surface, more nutriment is usually produced than is actually required to supply the wants of the cambium. It is generally supposed that the excess takes the form of starch and albuminoids, and, as such, is deposited in certain cells of the plant, where it remains over winter to be made use of during the following summer for the purposes of new growth. This, however, has been found not to be the case, or, at least under normal conditions, not to the extent usually supposed. In trees the chief repositories for this stored-up nourishment are the parenchymatous cells of the wood proper, and of the medullary rays. The latter run from the centre of the tree, or from some point a little removed, through the wood, cambium, and bast, and end in the cortex. They thus establish communication between all the main regions of the stem. If a cross-section of a healthy tree be examined with the microscope, it will usually be found that the cells of the medullary rays, as well as certain cells lying parallel to the axis of the stem, hold large quantities of reserve food, principally starch. These reserve supplies are scarcely found near the centre of large trees, but are very abundant towards the outer parts—especially in the alburnum. R. Hartig has made some very interesting observations on beeches with regard to this subject.[1] On the 25th of May, before any new growth in thickness had taken place, he examined a tree and found that all the store-cells still held their full supply of starch. Again, on June 15th, he made an examination, and found that about a fourth part of the new ring had been formed, and that the cells of the previous year's ring had parted with about the half of their starch; the cells lying deeper, however, were not at all affected. On July 6th, when half the new growth had been made, the previous year's ring had parted with still more of its starch, and the one lying immediately deeper was also half emptied. On July 27th about three-quarters of the growth had been made, and a little more starch had been withdrawn from the same two rings as before. On the 4th of September growth was completed, and the previous year's ring had regained a part of its starch, while the one immediately underneath was again quite full. At this time the newly formed ring itself showed a little starch. Had investigations been carried further, it would doubtless have been found that about the time of the fall of the leaf all the rings were again in possession of their full winter's supply of reserve materials.

It will thus be seen that only the two outer rings yield up any of their stores of food to assist in the formation of new wood or other plant-tissues, and that principally in early summer, before the tree has reached the period of active assimilation.

What has been stated is, however, only true under normal conditions. Hartig has made some investigations which show that the more deeply situated store-cells may be made to yield up their contents to allow the tree to form new wood. He caused two beeches (one fifty years old and the other a hundred years old) to be deprived of their branches, and to be kept in a leafless condition all summer. At the end of the year he examined them, when it was found that the younger tree had made 5 per cent of normal growth in thickness, and the other about 15 per cent. In both cases the whole of the starch had disappeared from all the cells. In the following year no growth at all took place. This shows that, when a tree is deprived of the means of collecting fresh food, the hungry cambium has the power of completely draining all the store-cells of their contents.

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[1] Das Holz der Rothbuche. Berlin, 1888. Pp. 38-49.

The question next comes to be: What are the real uses of these stores of reserve plant-food in trees? It is well known that trees as a rule do not bear seed every year, nor do they bear seed at all until a considerable age has been reached. If a tree be examined after it has borne a full crop of seed, it will be found that the stores both of starch and albuminoids have been greatly diminished—the only reasonable explanation being that what has disappeared has gone to furnish materials for seeds. Gradually the tree again refills the storehouses, and, when another large supply of reserve materials has accumulated, the luxury of bearing seed may again be indulged in. As has been already mentioned, Hartig found that, when deprived of branches and leaves, a fifty-year-old beech had only reserve material enough to form 5 per cent of normal growth; whereas a hundred-year-old beech under similar circumstances could make 15 per cent of normal growth. Now the beech is a tree which does not bear much seed capable of germinating until the age of fifty to sixty years is reached. There seems to exist a close relationship between these two facts. Young trees have not collected a sufficient stock of reserve materials to enable them to bear seed, and it is probable that the capacity to bear seed is essentially regulated by the amount of reserve materials collected by the trees. Very much larger additions are made to the reserve stores during a warm sunny summer than under opposite conditions, and this is the reason why full seed-years usually succeed warm summers rather than occur in the warm summers themselves.

The almost total absence of starch in duramen, and its presence in the alburnum, is a circumstance connected in a very direct manner with the difference in durability of these two parts of a tree. It is well known that the outside wood has not the same power of resisting the attacks of fungi as the wood lying nearer the centre. But the fungi which cause decay cannot live without food, and the food best suited to the growth and development of many fungi is just the kind which is found in the storehouses of the tree.

When the spores germinate on heartwood the young fungi do not find the means to sustain life, and so quickly die; whereas in the sapwood all is present that they require, and consequently, if moisture and heat be forthcoming, rapid increase takes place, and the wood is soon destroyed.

The absence of starch from the duramen is not the only cause of its greater durability—the deposition of gums, resins, &c., being even more influential; but still it is a circumstance which must by no means be overlooked.

The specific gravity of wood is probably the best test which can be conveniently applied to discover its quality. The specific gravity of timber depends directly upon the proportion which the firm cell-walls bear to the spaces (*lumina*) filled with air or water. In spring or early summer, when growth first begins, comparatively porous wood is formed, whereas in late summer and in autumn, dense, firm, heavy wood is produced. If a cross-section of a wood-ring be examined it will be seen that, in the case of conifers, the cells are large and thin-walled in the spring-zone, but pressed together and thick-walled in the autumn-zone. In broad-leaved trees the vessels will be found to be far larger, and usually much more numerous, in the spring-zone than in the later-formed wood—that is to say, there is in the former case much less firm wood-substance present.

Two theories have been advanced to account for this peculiarity in a wood-ring. The older and more generally accepted one is known as De Vries and Sachs' "Bark-Pressure Theory." Put shortly, it is as follows: In winter, owing to the mollifying action of water, to its freezing and thawing, and to changes of temperature generally, the bark is considerably loosened, so that in spring, when activity of the cambium recommences, much less pressure is offered to the growth of new cells than is the case in the later parts of the season, when the bark presses on the cambium very tightly, owing to the wood having increased in volume. In the early part of a growing season the cambium rapidly produces wood under reduced pressure, the wood being consequently very porous; whereas in autumn the wood produced is very dense, because the cambium is then working under greater pressure. One argument in support of this theory is, that if the pressure on the cambium be relieved, naturally or artificially, the part of the ring formed at the point of relief is broader than any other part. For example, if the outside rings of a section of an old thick-barked stem be examined, it will be seen that they do not follow a regular course, but pursue a more or less undulating one. A careful examination will show that the points of swelling correspond to places where deep fissures occur in the bark—that is to say, places where pressure is reduced—while the points where the rings bend in towards the centre correspond to places where the bark is firm and entire. The same thing may be seen on a larger scale, where by any means (*e.g.*, intense cold or lightning) a tree has been longitudinally cracked. If the rupture is of long standing, the circular character of a cross-section of the stem is more or less departed from, for, owing to excessive growth in the neighbourhood of the crack, induced by reduction of the pressure on the cambium, the tree shows a striking protuberance at that point.

The other and newer theory may be called Hartig's "Nutrition Theory." According to it the spring-wood is not so firm as the autumn-wood, because, in the early part of a growing-season, the conditions are not present which enable a tree to assimilate rapidly, and therefore there is not so much plant-food available for the formation of cell-wall materials. One fact may be mentioned in support of this theory. If a tree, in the course of summer, be deprived of its leaves—either by artificial stripping, or owing to attacks of insects—the formation of the wood-ring ceases. As soon as the tree has again clothed itself with leaves a new ring is commenced, and the first cells formed are thin-walled ones, very like those of the spring-wood. Hartig says that the peculiarity of these cells is due to the same cause as the character of those of the spring-wood—namely, want of sufficient nourishment. This explanation of Hartig's, though it has much to support it, does not seem quite to meet the case; for although no frost may intervene when the tree is denuded of leaves during summer, still, owing to changes of temperature which are sure to occur, and to the action of moisture, the pressure must be considerably relieved during the few weeks of rest, so that, when growth is again resumed, very much the same condition of things as regards pressure will be present as existed in spring.

It has already been said that the specific gravity of wood is dependent on the proportion existing between the firm walls of the cells, fibres, and vessels, and the open spaces (the so-called *lumina*); the same thing is stated in other words by saying that it depends on the proportion of autumn-wood to spring-wood. It is generally believed that, in the case of conifers, narrow-ringed wood is best, and that, in the case of broad-leaved trees, the opposite is true. The belief rests, so far as conifers are concerned, upon the authority of Mohl,[1] who said that the amount of autumn-wood remains very constant, and that increased breadth of any ring is entirely due to greater development of the inferior spring-wood.

Sanio, who carried his investigations much further than Mohl did, has shown that the rule is by no means generally applicable.[2] His researches, conducted on Scots pines, showed that, quite independent of the absolute ring-breadth, the proportion of autumn-wood to spring-wood steadily decreases as a stem is followed up, and that, therefore, the best wood is at the bottom. R. Hartig has gone thoroughly into the whole question, and has, besides establishing other conclusions, completely confirmed those of Sanio. A summary of the results of Hartig's observations is embraced under the following four paragraphs.[1]

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[1] Botanische Zeitung, 1862, p. 228.

[2] Pringheim's Jahrbuch, vol. ix., 1873.

1. The spring-wood zone, where trees are grown in an ordinary close wood, increases in breadth as the stem is followed upwards to the crown, but inside the crown the breadth diminishes. The greatest proportionate breadth of the autumn-wood zone, and therefore the heaviest timber, is found at the bottom of the stem, and the farther up the stem we go, the more does the influence of the spring-wood zone make itself felt, until, inside the crown, the wood again becomes better, and continues to improve till the top of the tree is reached.

2. In the upper parts of a stem it was always found that the broadest rings held the best wood, because they contained relatively little spring-wood; in other words, narrow-ringed wood was of low quality, for it was always accompanied by relatively large development of the spring-wood zone.

3. A tree which is very much crowded in youth forms good wood, but if the crowding be long continued, the autumn-wood in the lower parts of the stem becomes relatively scarce, and, indeed, may altogether cease to be formed; whereas, in the upper parts of the stem—where, in crowded trees, the rings are broader than below—the autumn-wood is more plentiful, and the timber therefore better.

4. At every point where observations were made, the innermost sixty rings contained relatively most spring-wood when they were broadest; whereas, in the case of the rings lying outside the innermost sixty, the spring-wood zones were relatively small when the absolute ring-breadth was great.

The results noted in the last paragraph, so far as they relate to the wood formed during the first sixty years of a tree's life, agree with those obtained by Mohl, who evidently attempted to generalise upon his results, without examining any older trees.

Perhaps enough has been said to show that broad-ringed, that is to say, quickly grown coniferous timber, is not necessarily of poor quality; let us now see how ring-breadth affects the quality of the timber of broad-leaved trees.

The wood of broad-leaved trees is of a more complicated character than that of conifers. In the former, each year's ring contains, as an essential part of its composition, a large number of vessels, which are generally distinctly visible to the naked eye. Both the size and number of the vessels are dependent on the quantity of water conveyed and transpired, and this again is, to a large extent, regulated by the amount of leaf-surface. A vessel is formed owing to the absorption of the end walls of a row of cells, standing perpendicularly one above the other. In this way long delicate tubes result, which, in the outermost wood-ring of a tree of any given age, run from the roots up to the branches.

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[1] Das specifische Frisch- und Trockengewicht des Kiefernholzes. Berlin, 1874. Pp. 11-16.

The diameter and total number of vessels in a ring hardly vary throughout the whole length of a clear-bole (*i.e.*, the branchless part of a stem), but the number per unit of sectional area must increase as the stem is followed upwards. This is self-evident, owing to the conical shape which a tree-stem almost always assumes. The vessels seldom contain anything but air and water, and, as the following table shows, their distribution exercises an important influence upon the specific gravity, and therefore upon the quality of timber:—

TABLE SHOWING THE CONSTITUTION OF THE WOOD FORMED BETWEEN THE 90TH AND 120TH YEARS OF THE LIFE OF A BEECH.[1]

Height in Feet.	Average Number of Vessels per square inch of Cross-section.	Average Cross-sectional Area of each Vessel in sq. inches.	Average Proportion of Vessels to Wood. (Wood=1.)	Average Annual Increase, as shown on a Cross-section, in sq. inches.	Average Number of Vessels in each Ring.	Specific Gravity.
4	87,096	$\frac{1}{181,474}$	.472	2.527	218,700	.645
18	93,548	$\frac{1}{181,474}$	.507	2.371	220,400	.638
35	100,000	$\frac{1}{181,474}$	.542	2.106	209,250	.632
52	112,903	$\frac{1}{181,474}$	.612	2.059	231,000	.606
69	116,129	$\frac{1}{181,474}$	.630	1.997	230,400	.600
86	141,935	$\frac{1}{645,160}$	.220	0.811	114,400	.702

The second column shows how, as the stem is followed up, the number of vessels per square inch of cross-section steadily increases, owing to the tapering character of the bole. The average size of the vessels, as shown in the third column, remains constant till the crown is reached at the height of 69 feet, when it soon falls to less than one-third, no doubt because much of the water has been diverted from the main trunk into the branches. Of course vessels also leave the stem for the branches, and the sixth column shows that, within the crown, their number has been reduced about one-half. The fourth column is very instructive, and shows that the relative space occupied by vessels steadily rises till the crown is reached, when it falls about two-thirds. Looking for the cause of this, the figures shown in the sixth column would lead one to expect a drop of one-half, while those in the fifth column show that even this is more than dissipated owing to the decrease in the annual increments at the height of 86 feet; the whole is explained, however, by the diminished size of the individual vessels, as shown in the third column. The results of the specific gravity determinations, as shown in the seventh column, are exactly what the contents of the other columns would lead us to expect. As the number of vessels per unit of area of cross-section increases —their individual size remaining constant—so must the specific gravity decrease; and when, after the crown has been reached, we see the figures in the second column still increasing, and those in the last increasing as well, we find a perfectly satisfactory explanation by turning, more particularly, to the third and fourth columns.

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[1] Das Holz der Rothbuche, p. 27.

This subject might be greatly extended, but enough has been said to show how intimately specific gravity (and therefore quality) is connected with the frequency and size of the vessels.

TABLE SHOWING THE AMOUNT AND SPECIFIC GRAVITY OF THE ANNUAL INCREMENTS OF TWO BEECHES BEFORE AND AFTER PRUNING.

Height in Feet.	80 – 90.				90 – 99.			
	STEM 1.		STEM 2.		STEM 1.		STEM 2.	
	Average Annual Increase.	Specific Gravity.	Average Annual Increase.	Specific Gravity.	Average Annual Increase.	Specific Gravity.	Average Annual Increase.	Specific Gravity.
4	5.991	.645	2.060	.651	4.926	.645	1.451	.637
18	5.406	.649	1.786	.651	3.136	.657	1.566	.645
35	2.935	.632	1.091	.737	4.800	.671	2.277	.755
52	0.524	.650	0.488	.760	1.104	.736	0.715	.762
Whole stem	...	.644	...	.638	...	.668	...	.708
Total annual increase in cubic feet	1.391		.490		1.352		.622	

When a well-branched and full-leaved tree occupies an open sunny situation, the maximum evaporation may be looked for. At first it would appear as though this must necessarily mean large annual growth, for it is only owing to the removal of water by expiration through the stomata of the leaves that the mineral food rises in the stem. But when we reflect that it is quite possible for the increased stream to be so much weaker that really no more food, though more water, is conveyed from the ground, we must conclude that increased growth need not take place, and that the vessels are being largely used to convey superfluous water. The preceding table, compiled from Hartig's researches, will make this point clear.

The trees to which the table refers were well provided with branches till they had reached the age of ninety years, when the lower parts of the stems were completely denuded of branches, whereby, it was calculated, the extent of the original leaf-surface was reduced more than a half. In this state the trees were allowed to grow for nine years, when they were felled and examined. The first half of the table refers to their growth in the decade before pruning, and the latter half to the nine years thereafter. Heights at which investigations were made are given in feet; average annual increments, as shown on cross-sections, are given in square inches, while the lowest line of figures expresses, in cubic feet, the average annual increments over the whole of both stems during the two periods, before and after pruning.

With these remarks it is hoped that the table is self-explanatory, but attention may be directed to a few points. After pruning, the quantity of wood formed annually in the lower part of the trees fell off considerably. This state of things was brought about by the removal of the lower branches having caused the whole upward flow of mineral plant-food to confine itself to the main stem, so that the cambium at the base had to depend for its nourishment entirely upon what remained over after the cambium situated nearer the crown was satisfied. Formerly the cambium in the lower regions was partly nourished by the food elaborated in the leaves of the lower branches, but, after pruning, this supply was cut off. In the upper regions, very marked increase in growth resulted from pruning, for, afterwards, the upper parts were better supplied with mineral matters, as there were then no low branches to tap the ascending stream. Previous to the age of ninety years, it is evident that the tops of the trees had been insufficiently provided with mineral salts.

The total annual increment remained about the same after pruning, in the case of the first tree, but in the case of the second, very marked increase resulted, amounting to no less than 27 per cent. This was owing to the removal of so many large branches, which, therefore, did not afterwards require to be nourished, thus concentrating far more growth in the stem. Although the amount of leaf-surface was very much reduced by the pruning, the leaves which were left worked with more effect, thus showing that originally the number of leaves was in excess of actual requirements.

With regard to the quality of the wood formed after pruning, a glance at the lowest line but one of the table, will show that the specific gravity, in the case of both trees, is much raised. This improvement is due to the fact, that after a large number of branches were removed, the amount of water transpired by the leaves, and consequently conveyed by the wood, was greatly reduced. There were, therefore, not so many vessels—that is to say, the wood was denser, firmer, heavier, and in every way improved. Another point to be noted is, that the greatest rise in the specific gravity is found in the upper regions of the stems—namely, in those parts which showed greatest increase in the breadth of the annual rings. From this it will be seen that it is possible, by extensive pruning, to raise the production of wood in a stem considerably, but it must be remembered that a certain minimum quantity of branches is sooner or later reached, when the removal of a single twig must be accompanied by diminished production. In practical forestry, natural pruning is best—that is to say, the trees in youth should be grown in such close woods that the lower branches are killed off while still small.

In drawing these remarks to a close, we shall look for a little at a few of the results which accompany severe thinning of a middle-aged or old wood. "Light-thinning" is the term applied to the process, because it is intended to imply that the thinning has been carried to such an extent, that the rays of the sun can afterwards pierce the foliage and fall upon the ground.

When a healthy tree, which has grown in a close wood, is more or less isolated by the removal of its neighbours, a great change is wrought in its growth, as well as in the influences which affect it. The sun obtains unrestricted access to its crown, so that a greater quantity of carbonic acid gas can be decomposed by the leaves; the wind can blow more unrestrained through its branches, therefore evaporation is stimulated; and the dormant eyes and dwarf-shoots develop into normal shoots, and so a large addition is soon made to the foliage. Then, again, the free access of sun, air, rain, and snow to the humus in and on the ground, has the effect of inducing rapid decomposition, and thus of setting free large quantities of available plant-food. The feeding area of the roots is also much extended, for those of the trees removed are taken out of competition with those which are left, so that the latter are able to take up more mineral food. The combined effect of all these causes is, that the tree very soon shows marked increase in diameter-growth. Another effect of light-thinning, but one which we cannot discuss here, is, that trees perfectly barren in a close wood, bear seed abundantly a few years after the operation has been accomplished. It is by judiciously light-thinning that the natural regeneration of forests on the Continent is so successful.

Confining ourselves merely to the question of increased mass, let us look at the manner in which it is affected by the new conditions. There are those who maintain that the stimulated growth is induced only by the increased amount of foliage. Here, it must be remembered, we are dealing with trees provided with very small crowns, so that there can be no doubt that the addition made to the foliage makes itself felt ultimately in increased production of wood. But, as a matter of fact, the annual increments often show increase so soon after light-thinning that there can have been no time for the foliage to increase to any appreciable extent. Michaelis examined sixty-six spruces, which formed part of a wood which had been light-thinned during the winter of 1875-1876, and found that 8 per cent of them showed an increase over normal growth in the first year, 35 per cent of them in the second, and 41 per cent of them in the third.[1] Nördlinger, after giving the subject much careful study, came to the conclusion that "Trees which are isolated after having passed their earlier life in a crowded plantation show increased breadth of ring the very first year."[2] He expresses the opinion that the increased growth in the first year cannot be accounted for by increase of foliage, for the amount of leaf-surface in the year succeeding light-thinning is practically the same as in the preceding year. He believes the explanation to be that, after the removal of the other trees, the same area of leaf-surface is enabled to work much more effectively. Th. Hartig endorses his opinion, so far as the first year is concerned, and largely attributes the increased growth in the following years to the consumption of the plant-food stored up in the forest-humus.[3]

As regards the quality of the increase, our former considerations of the specific gravity of broad and narrow ringed wood should assist us to a conclusion. With regard to conifers, the age of the tree will have some influence; but as it is quite certain that broad-ringed wood produced by coniferous trees, after they have attained the age of about sixty years, is better than narrow-ringed wood furnished by similar trees, and as no trees should be isolated or woods be light-thinned till considerably past middle life, we may conclude that conifers are well suited to the system. As regards broad-leaved trees we are on even firmer ground, for we have the results of numerous corroborative investigations to guide us. The latest contribution to the subject comes from the pen of R. Hartig, who shows the case so clearly that it will be well to give some of his figures.[1] He examined two beeches which up to the age of 143 years formed part of a large closely stocked wood. Their neighbours were then felled, while they themselves were left to grow for other seven years, when they were cut down and investigated.

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[1] Forstliche Blätter (1884), p. 286.

[2] Forstbotanik (Stuttgart, 1874), vol. i. p. 164.

[3] Lehrbuch für Forster (2d ed., Berlin, 1875), p. 86.

TABLE SHOWING ANNUAL GROWTH AND SPECIFIC GRAVITY OF WOOD FORMED BEFORE AND AFTER LIGHT-THINNING.

Height in Feet.	STEM 1.				STEM 2.			
	120—143.		143—150.		120—143.		143—150.	
	Average Annual Increments, as shown on a Cross-section, in sq. inches.	Specific Gravity.	Average Annual Increase.	Specific Gravity.	Average Annual Increase.	Specific Gravity.	Average Annual Increase.	Specific Gravity.
4	1.288	.583	6.398	.726	1.536	.603	4.771	.739
18	1.192	.592	3.265	.691	1.188	.579	3.194	.719
35	0.975	.602	2.073	.682	0.932	.574	2.347	.693
52	1.059	.612	2.559	.692	0.743	.576	1.019	.631
69	0.707	.656	0.724	.647	0.327	.658	0.330	.637
78	0.059	.705	0.088	.700	...	...	...	...
Whole stem	...	.609	...	.696	...	.591	...	.705
Total annual increase in cubic feet	0.546		1.369		0.465		1.088	

Looking first at the specific-gravity columns, we cannot fail to be struck by the enormous improvement in quality which has resulted from the light-thinning, and it will be seen that the improvement is greatest where the increase in quantity is greatest. As compared with the specific gravity of the wood formed over the whole stem during the twenty-three years prior to light-thinning, the specific gravity of that formed afterwards, in the case of the first tree, shows a rise of 14 per cent, and, in the case of the second, of 19 per cent. This is certainly a very striking confirmation of the view that broad-ringed wood furnished by dicotyledonous trees is of better quality than that which is narrow-ringed, and goes far towards justifying the system of light-thinning.

Hartig was so struck with the great change which had come over the quality of the wood, that he determined to try to demonstrate the exact cause. With this end in view he submitted a few sections of the first stem to microscopic examination, and the following table gives some of the results:—

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[1] Das Holz der Rothbuche, p. 56.

TABLE SHOWING THE DISTRIBUTION AND SIZE OF THE VESSELS IN STEM 1, BEFORE AND AFTER LIGHT-THINNING.

Height in Feet.	Number of Vessels per square inch.	Average Sectional Area of Vessels in fractions of a square inch.	Proportion of Vessels to Wood. (Wood=1.)	Average Number of Vessels in each Ring.
		120th — 143d Years.		
4	90,322	$\frac{1}{181,474}$	.490	116,340
52	109,677	$\frac{1}{322,580}$	.340	116,110
		143d — 150th Years.		
4	40,645	$\frac{1}{181,474}$	.220	260,000
52	100,000	$\frac{1}{181,474}$	.542	255,900
78	241,935	...	...	...

This table should be studied along with the previous one. It will be observed that, at the height of four feet, the average number of vessels per ring is more than doubled after light-thinning. This large addition to the number of vessels is required to accommodate the extra flow of water up the tree, consequent upon increased evaporation in the leaves. At the same height the average annual increments have increased nearly five times. Thus, though the number of vessels has more than doubled, they have now about five times as much wood throughout which to distribute themselves—the proportion of vessels to wood has therefore fallen correspondingly—and the final result is a rise of 24½ per cent in the specific gravity.

Still more striking than the enhanced quality of the wood is its distribution over the stems. The amount of the average annual increments, taking both stems together, after light-thinning, as compared with that of the average annual increments before the operation of light-thinning was performed, reveals the enormous rise of 145 per cent (156 per cent and 134 per cent). The increase is greatest at the base of the stems, where it averages over 300 per cent (397 per cent and 211 per cent), and gradually dwindles away as the stems are followed up, till it almost disappears at the top. The explanation of the improved quality of the wood, and the distribution of the increment after light-thinning, is that the removal of a number of trees enlarged the feeding-ground of the roots of those left standing, allowed the sun to exert its full effect on the leaves, and the wind to stimulate evaporation, while each year would witness considerable enlargement of the leaf-surface; but, most important of all, large quantities of rich soluble plant-food would be placed at the disposal of the trees, owing to the decomposition of the store of humus in the soil.

The grand effect is increased activity of the vital functions. The enormous increase of growth in the lower parts of the stems, and its comparative insignificance in the upper parts, are due to the fact that, even when the trees were in the crowded wood, their upper regions were sufficiently nourished, and therefore showed the maximum of growth, whereas the lower parts were insufficiently supplied with food, and so growth there was checked. After large additional food-supplies were placed at the disposal of the trees the cambium in the upper regions made hardly more wood than formerly, because it had all along been fully supplied with food, and consequently could not digest the excess offered, which therefore passed on unused, to be appropriated by the cambium situated lower down. After light-thinning, therefore, the maximum of growth was possible in all parts of the stems, whereas, formerly, it was only possible in the parts near the crown.

Other interesting observations on the behaviour of trees after a wood is light-thinned are recorded by König,[1] Nördlinger,[2] and Riniker;[3] but as they merely confirm those already quoted, this reference to them must suffice.

Having seen that increased growth can be induced by the treatment indicated, let us now look at its duration.

The growth of a tree, both in height and thickness, takes place according to certain definite laws. In the earlier years of a tree's life growth is constantly increasing—that is to say, each year's increment is in excess of that of the previous year, and this goes on till a maximum is reached, when it begins to decline, until a time arrives when no further growth is made. This latter point may not be reached till after the lapse of centuries, but the maximum of growth is soon reached—sooner on good soil than on bad, and in the case of certain species of trees than in the case of others—in the great majority of instances it occurs before the fortieth year.

Very much the same thing occurs with the increased growth consequent on light-thinning. Kraft investigated five beeches, which had been partially isolated in 1834, when rather more than 100 years old, and found that the maximum annual increase occasioned by light-thinning was reached in the third decade by three of the trees, in the second decade by one, and in the first decade by one also. König got similar results after examining some beeches, so that it is evident, from the maximum appearing at irregular periods even in trees of the same species, that individual peculiarities, situation, &c., make themselves felt in this kind of growth as in all other kinds. If there is a large quantity of undecomposed humus in and on the soil, then the increased growth will be larger and be longer maintained than where there is but little humus to yield increased supplies of plant-food by its decomposition. Then, again, trees which have naturally great numbers of latent buds or dwarf shoots (*e.g.*, spruce, silver fir, oak, beech, &c.), will show increased growth after light-thinning for a much longer period than trees which, owing to comparative absence of latent buds, or of dwarf shoots capable of further development (*e.g.*, pines), are unable to increase their mass of foliage much. Thus, the behaviour of the oak and the Scots pine after light-thinning is very different, even when standing side by side and subjected to exactly the same influences as regards quality of soil and amount of light. The oak will show increased growth over the normal after light-thinning has been accomplished for forty or fifty years, because during the first few years it gets an increased amount of food from the soil, and when this is exhausted, its latent buds have developed so much under the influence of increased light and nourishment that largely increased growth is still maintained. In the case of the Scots pine increased growth is made for a few years after light-thinning, just as in the case of the oak or any other similar tree, but whenever the food in the soil begins to fail, so does the formation of wood, because the Scots pine is very poorly supplied with latent buds, and although richly furnished with dwarf shoots, these are not capable of development into ordinary shoots, so that but little addition is made to the area of green assimilating tissue. As has been proved from actual investigations, the increased growth consequent on light-thinning, in the case of the Scots pine, only endures for about ten years—namely, so long as the increased food-supplies of the soil hold out.

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[1] Forstliche Blätter (1886), pp. 39-53. [2] Kritische Blätter, 52, i. pp. 80-90.
[3] Praktischer Forstwirth (1886), pp. 140, 166.

The process of light-thinning can be made to subserve important practical ends. Suppose we strongly thin a close wood, removing from twenty to fifty per cent of the trees, light enough is admitted to the ground to enable us to begin the process of regeneration. Larches, birches, or even Scots pines, do not grow well under the shade of other trees, but beeches, silver firs, or spruces will make considerable growth even in moderately restricted light. By selecting the proper species of trees for the second generation, we may rear a flourishing young wood under the shade of the older trees, so that, when the latter are removed, the area is not only restocked, but is restocked with trees, it may be twenty or more years old. In this way we avoid leaving the ground exposed to sun and wind, which so soon remove moisture and reduce fertility, and which occasion so much loss under the clear-felling system. Then, again, during the period which the regeneration occupies, the trees of the older generation are increasing very rapidly in size, so that in a comparatively short time they will have added so much to their former volume as to be fit for purposes which their former smaller size entirely precluded. We therefore obtain not only a much larger mass of wood, but the rate obtainable per cubic foot will also have increased considerably. Some damage is done to the younger trees in felling the older ones, but if experienced workmen are employed, and due care is exercised, it is found, in actual experience, that the loss in this way is comparatively trifling.

ON THE MARINE LIFE DESTROYED BY THE TRAWL, AND ITS INFLUENCE ON FISH LIFE.

By W. ANDERSON SMITH, Ledaig, N.B.

[Premium—*Five Sovereigns.*]

THE question of trawling—more especially that called Beam-Trawling—has of late years caused much friction between the different classes of fishermen, and the result has been that the Government has virtually closed the coast within the three-mile limit.

But before this decision was arrived at, Royal Commissions and Special Investigations had repeatedly reported in favour of the trawl as a quite innocent mode of fishing; and the reports which were supposed to be the ground of action of the Government, did not always themselves appear to bear the interpretation that had been placed upon them, adverse to the trawlers.

While of opinion, at the same time, that cause has been shown in certain quarters why this mode of fishing should be regulated, we frankly acknowledge that the arguments against it have commonly proceeded on entirely wrong lines. If we listen to the line fishermen, who are mainly interested, the destruction of fish spawn is one of the commonest and strongest arguments adduced against this great engine; while the scientific—or pseudo-scientific—opponents of the system, point more to the destruction of immature fish, as the great reason for its scene of operations being thrust farther seaward.

The scientists, who examined into the first-named cause of opposition to the beam-trawl, clearly proved that the fish ova destroyed by the trawl must be very limited—as the eggs of the great proportion of marketable fish float, and are consequently quite beyond the influence of the sole-rope or net.

On the other hand, the destruction of what are called "immature" fish, is proved to be often quite as great on the part of the liners as on the part of the trawlers themselves. Thus in one year over 1000 tons of immature haddock and whiting were said to have been landed by liners at Aberdeen alone—more than came ashore from trawlers. Even although the term "immature" is very indefinite, it appears as if we could scarcely advance either of the above views as sufficient reason for thrusting this great industry farther out to sea, away from the inshore beds.

Yet the contention of the opponents of the trawl, as to its bad effect on the inner waters, we hold to be based on much more reliable data; and we will endeavour to show from the facts in our possession the reason why the beam-trawl may be so injurious to our fisheries, and the Act prohibiting its inshore use be so important for the welfare of the fishing industry as a whole.

To properly understand the influence of the beam-trawl, it is necessary to bear in mind the recent development of the instrument in the first place; and in the second, to appreciate the influence of their food-supply upon the whole question of the movements and abundance of any and every class of fish.

The beam-trawl has kept advancing in size and might until it is now frequently from 50 to 60 feet in length, with a huge beam poised upon heavy iron runners, and a heavy ground-rope curving beneath, and tearing up the sea-bottom. If the ground be composed of stones or tenacious mud, tons of the material are carried along, and the meshes of the net closing with the pressure of water and material, even mud is brought on board as certainly as if the end of the net were a great bucket, in place of a wide-meshed net. In this way the most minute animals are abundantly captured in the trawl net, and the whole conditions of the sea-bottom changed. If the bottom is hard gravelly material, the result is still more disastrous. Every stone is dragged on board, or swept clean of growth, until the whole sea-bottom, in those portions regularly frequented by the trawling fleet, may be said to be reduced to a uniform state of destitution.

It should be clearly understood that the destruction of old or partially grown fish is not so certain to drive fish from a district as the destruction of their food. Where food is absent or scarce, fish will not often come nor long remain.

The exception that proves the rule is the temporary visit of fish when spawning—as plaice on certain banks, or cod on certain sea-bottoms. But, leaving herring aside for the time, our marketable white fish are mainly found where food is procurable—and procurable in plenty. Their principal food-supply is obtained from the invertebrate life—such as crustacea, mollusca, and the star-fish class (*Echinodermata*). To all of these the trawl is a persistent foe. Crabs of all kinds are captured and destroyed by it, all classes of shell-fish are swept on deck in its meshes, and the sea-bottom is almost cleaned of the whole class of *Echinodermata* where trawling prevails.

This is therefore an immediate and direct attack upon the fish, as we would attack an enemy's country by destroying its flocks and herds. But this is not the only mode in which the fish are attacked. Even when we fail to clear off the crabs and whelks, the star-fish and sea-urchins, we clear off *their* food and compel them to migrate.

The low-class life that is without popular nomenclature, and includes such creatures as corals and sponges, dead-men's fingers (*Alcyonia*), sea-firs, and sea-pens (*Sertularidæ* and *Pennatulidæ*), are largely preyed upon by the crustacean and molluscan life that comes next above them in the scale of life. We have stripped scores of quaint-looking crabs (*Arcturus*) from one great stem of a sea-pen (*Pavonaria quadrangularis*, Cuv.) on ground frequented by haddocks. The crabs were eating the polyps, and the fish then ate the crabs. If we destroy the "pens" with their polyps, we do as much injury to the fish as we would to our neighbour's cattle if we were to destroy their pasture.

All around our coast there may be said to stretch great fields of sea-weed and rocky grounds that are the nurseries of fish. Amongst these the young find protection and food. It is fortunate that a great portion of this ground is such that the beam-trawl can never be made to travel over it. Again, in the west of Scotland there is the further advantage to the fisheries, if not to the trawlers, that the sea-bottom is sprinkled with great boulders that are fatal to any attempt at trawling under ordinary circumstances with ordinary gear. But wherever the bottom is regularly traversed by the heavy trawl, and everything scooped up, there is no shelter and no food. Everything that is not taken is shaken loose. The zoophytes—low-class life—are buried in the mud, torn adrift, or otherwise destroyed. The food-supply is removed, the shelter is removed, and the whole bottom rendered barren for a time. We do not say that this is incurable or would necessarily last long: a twelvemonth would probably restore it if there was any cultch on which to stick, or any fringe of unworked bottom from which the spores and spat could come. But meantime the ground does not get six days' respite in place of six months, and the chance of resuscitation is dependent upon such a measure as the Act that has ordered the beam-trawl to keep outside the three-mile limit!

This will give a chance to the ordinary liners, it will preserve a nursery for the smaller fishes, and it will greatly benefit the trawlers themselves, who will undoubtedly reap the advantage of the larger fish-supply, so soon as these are big and strong enough to go out to the deeper waters.

Marine life is to a large extent a counterpart of that on land. Although men do not eat grass directly, still so long as they eat animals whose main sustenance is grass, the destruction of pasture is the destruction of man's food. But fish are to a large extent even more omnivorous, and still more voracious, than mankind. A hungry cod will eat anything, and on ground regularly traversed by the trawl it would not require to be too fastidious.

We look upon cod and haddocks as supplying from their stomachs a fair idea of the fauna of the sea-bottom from which they have been taken. We have drawn from their stomachs almost every species of crab, from the largest to the smallest on the coast. They swallow large buckies, shell and all. They will even devour stones that are covered with a heavy growth of *Hydrallmania*, or sea-fir. The same may be said of most other of our best edible sea-fishes. Indeed a catalogue of the contents of the stomachs of our ordinary marketable fishes would include, in our experience, all the invertebrate fauna of the ground over which the trawl passes. We have seldom met any living object in the material thrown on the deck from the trawl, that we have not likewise seen amongst the contents of the stomachs of fish examined by ourselves.

It may be said that much of this material is recommitted to the water from the decks of the trawlers, and this is to an extent undoubtedly true. But at the same time much is destroyed —all is loosened—and all that is of delicate consistence is injured ere ever it reach the deck. The pressure in the bag of a large trawl is very great, and little life survives it. Such growths as the sea-pens, and other zoophytes, once loosened of their hold, are destroyed. They cannot again fix, and the whole community, if returned to the water, would be choked in the mud, or become a ready prey to those minute entomostraca which may be called the scavengers of the sea.

The only important food-supply to the fishes, that may be considered uninjured by the trawl, are the annelids or sea-worms; but even the highest development of this family, the sea-mouse (*Aphrodite*), is no more safe from the trawl than it is from the cod-fish.

We thus find that this great engine tears up the sea-bottom, and practically clears it of its invertebrate life, so that the stretches of bottom covered with zoophyte growths are destroyed as fish nurseries. The crustacean fauna is killed or captured, or its food-supply removed. The molluscan or soft-bodied fauna is likewise destroyed, while the sea-urchins and star-fish are cleared away wholesale.

The whole sea-bottom is thus impoverished; and if it were not that stretches here and there of rocky or broken ground prevent the use of the trawl, and thus secure certain spaces free from its action, the injury to the general fisheries of the country would be even greater than it has proved to be.

The result of the recent Act will be to secure a broad belt of neutral ground around our shores as a nursery for young fish, by preventing the removal of natural growths, and the accompanying fauna, by the action of these great engines.

This should also eventually improve the off-shore fisheries, as it is found by experience that so soon as fish strengthen and increase in size they grow bolder, and proceed off-shore to the farther banks or deeper waters. The one important necessity for fish—as for other animals—is food; the next is shelter for the young after the incubation of the ova and the absorption of the umbilical sac. The protection of a shore-belt is with the view of providing these two necessities for our marketable fishes.

Besides the destruction of the great invertebrate food-supply of our fishes, the trawl most undoubtedly—in the case of flat fish more especially—creates great havoc amongst the most immature and unmarketable fish. This is more particularly the case as regards the small inshore trawls, whether used for shrimps in the Solway Firth or for flounders in the Moray Firth. The immense numbers of flat fish taken,—from about the size of a shilling upwards,—are out of all proportion to the mere handful of shrimps captured by the net. They are rarely thrown overboard, and, even then, the pressure and subsequent treatment have probably meantime destroyed them. From 150 to 180 little slips of creatures, valueless as food, have been counted in one haul of a shrimp-net.

It would be out of place here to give from our note-books a list of the low-class life destroyed by the trawl, that either directly or indirectly forms the food of our ordinary marketable fishes. It includes all classes of life except the commoner annelids or sea-worms, and even these are taken in quantity although they may be swept back again in the washing of the deck.

It can never be too often repeated that if we capture the lower-class life upon which our fishes largely depend for subsistence—whether it is captured for food, or merely as an accessory—we cannot expect to obtain the fishes also. If we clear away the zoophyte growth amongst which the young shelter, and upon which they partially subsist, the result must be disastrous. If superior reaping and gleaning machines, by shortening stubble and preventing waste, have driven away the partridges from certain districts, the more drastic action of the trawl must be still more apparent at sea.

When we turn to herring the problem is more difficult. There can be no doubt that on the west coast, where the herring spawning-grounds are known and have been severely treated by the trawl, the injury to the spawn as well as to the spawning fish is of a very tangible character. In fact, the favourite banks become so altered and so persecuted, that the herring (in Loch Fyne, say) have been driven from place to place in their endeavours to find suitable spawning-places, and have gone deeper and deeper in their efforts to escape destruction or injury.

And here our knowledge of the character and habits of the herring must come to our aid. The proofs are accumulating that our best herring are local in character, that they feed off the grounds on which they are captured, and consequently, although not feeding when in good condition, they are yet fattened in the vicinity, and dependent upon the life of the ocean-bottom for their delicacy. This being the case, the injury done to them by the trawl is quite as distinct as to their neighbours the white fish.

Again, it must not be lost sight of that, although the herring supplies abundant food for the white fish, the white fish in their early stages attract equal attention from the herring. We have taken herring in multitudes when they were living mainly upon sand-eels; and the whole catch of herring last year at Barra, during June, was commonly stuffed with young whiting.

Indeed the herring and white fisheries, in place of being antagonistic, are conterminous, and the two classes of fish feed upon one another with delightful impartiality. Whatever destroys the food of the white fish injures the herring that feed upon their young; whatever destroys the herring wholesale, reacts upon the white fish.

Then the ova of the herring is laid upon the zoophytes and other rough growths of the sea-bottom, and the clearing away of these removes both cultch from the ova and food from the young.

There has been more than one able attempt made to prove that the trawl is not injurious to fish life, dealing mainly with ova and young fish. But we cannot look upon the facts we have adduced as proving otherwise than that the action of this great engine inshore destroys directly most classes of the life upon which our fishes greatly depend for food.

We have shown that all these classes are captured or destroyed abundantly in the trawl. We can point to any list of fish foods to prove that fish greatly live upon such life.

We have explained that the small shrimp trawl, and small inshore trawls in use in restricted areas, destroy directly great numbers of "immature" fish, quite out of proportion to the advantages derived from them.

It may therefore be concluded that the marine life destroyed by the trawl is of paramount importance in sustaining the ordinary fish fauna of the coast, and consequently that its preservation, so far as possible over certain areas, is a matter for national watchfulness.

TREES AND SHRUBS BEST ADAPTED FOR PLANTING AS SHELTER IN THE ISLANDS OF SCOTLAND.

By Robert Hutchison of Carlowrie.

THE frequency with which the remains of old tree-stumps and other traces of indigenous woods of a former growth are found along our coast-lines and embedded in the soil of many of the islands of Scotland at the present day, where now hardly a tree is to be seen, affords ample proof that once upon a time, and probably at no distant date, these islands, and other sea-coast districts along our shores, were densely covered with indigenous wood, and that not unfrequently of large proportions. How then comes it about that these districts, and so many of the numerous islands which surround Scotland, are now devoid of timber, or shelter of any kind? No doubt, in early times and in feudal ages, the pillage and destruction to which many of our western and more northern islands were subjected by the attacks of ruthless marauders and the plundering of rival clans, will account for much of their present denuded condition; and probably in such situations, when once vegetation has been banished, and the bare bleak face of nature is left to herself without any ameliorating circumstance to assist in any spontaneous effort at recuperation, it must prove almost impossible—unaided by human effort—to re-establish the pristine verdure which has been lost. But, doubtless, the efforts of man have not been directed timeously to restore the deficiency, till greater mischief through long delay has been done, and now the rehabilitation of these islands with healthy and thriving woodland becomes a matter of extreme difficulty and a problem of no easy solution in arboricultural effort. The long deterioration, moreover, to which the soil has been subjected from the absence of the annual leaf-fall and vegetable mould it formerly enjoyed, renders it more difficult to induce new growths of vigorous and robust habit to take root quickly and successfully.

The selection of suitable varieties of trees for planting, while most important, is not the first step to be taken in attempting to "reafforest,"—if we may use so large a term,—the islands lying around us; it is necessary, first of all, to select suitable situations on which to operate in forming sheltering plantations or pioneer belts to screen the trees planted for ultimate growth and permanency. In doing so due regard must be had to the exposure of the site, and its configuration: a long level slope towards the sea-coast is to be avoided; such a position affords no shelter of any sort, but rather, as it is called in nautical phrase, a "long fetch" to the prevailing wind, or severity of the sea-breeze. Where there are a series of undulations or declivities in the ground, or where the ground-level falls as it recedes from the sea-line, the process of planting with prospect of success is greatly increased, and shelter much more quickly attained. An elevated position above the coast-line is more desirable than a level stretch, for it is then less difficult to erect sheltering screens to protect the outer portions of any plantation, and the deleterious influences of the brine-charged sea-breeze have exhausted themselves at the lower altitude. Much may be done to assist nature in such situations by trenching the ground where it is proposed to form plantations. No doubt this is an expensive operation, and one which many proprietors may grudge for such outlying and probably unprofitable portions of their property; but it must be borne in mind that where it is desired to clothe any area with *successful* plantations, and if it does not consist of mere sand-drift, the process of trenching will amply repay the cost, by the plantations rapidly taking root and accommodating themselves to the site, so that in a very few years they not only give promise of forming profitable timber, but yield an indirect but important advantage by the shelter they afford, and consequently the fertility they create over the adjoining lands, and which perhaps, but for the start given them through this stimulus to vegetation, would have continued barren and unfit for planting with any probability of ultimate return.

We have many examples recorded in various parts of Britain where extraordinary success has, in a few years, attended plantations formed in exposed and sea-coast situations after judicious trenching, and without which they would not have thriven in such a satisfactory and marked manner. We need not mention here the well-known achievement in planting the Culbin Sands in Morayshire,[1] and other sea-coast situations in the north-west portions of Scotland, as well as the vigorous plantations in many parts of Skye and the western shores of Mull, by the labours of Mr Munro M'Kenzie, and other island proprietors, whose arboricultural tastes, and knowledge of the various subjects desired to be turned to profitable account by planting, have led them to adopt the most approved methods of treatment. In England several good instances of successful coast planting may be seen on the property of Sir Thomas Fowell Buxton, Bart., at Runton and Trimington, and along the exposed coast of Norfolk, where upon a poor soil, on a hard tilly gravelly subsoil, after trenching to a depth in many places of 18 inches, and at an altitude of from 200 to 400 feet, the most unlooked-for and gratifying success has been achieved. We need not refer to the *landes* and sandy drifts in many exposed situations on the French coasts, which are too well known, and form remarkable examples of what may be done in the way of forming valuable plantations on the most unlikely sites by the ingenuity and forethought of the intelligent planter, in calling in the assistance of art and her resources in such situations, by preparation of the ground, forming screen-shelter, and the choice of suitable plants to resist the prevailing blasts and drifts, and thus assisting nature to struggle successfully with the most adverse circumstances.

But besides the preparation of the ground in suitable places by trenching, much assistance may be given in starting young plantations by forming sheltering screens. These should be formed of brushwood or plantation thinnings placed like hedges, and fastened to the ground by stakes at appropriate distances, or turf-dykes may be raised to break the force of prevailing winds. Where brushwood or thinnings are adopted, screens may easily and inexpensively be raised 6 to 10 feet high, which will stand for several years if securely fixed in the ground. Such screens, or artificial hedges, may be made of cut branches of spruce-fir, fastened like garden pea-stakes to two lengths of paling-rail, securely fixed by stobs of 6 feet in length, driven into the ground every 12 feet apart. By such an appliance, all the advantages of a live hedge are obtained, and the shelter so produced is far more beneficial than what is afforded by either a turf-dyke or stone wall, over which the prevailing winds bound with redoubled force, and leave the trees in the young plantation cut across, about the level of the top of the wall or dyke, as it were with a pruning-knife.

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[1] Highland Society's 'Transactions,' vol. iii., 3d Series, p. 73.

The selection of the varieties of trees best adapted for planting for shelter in island and on sea-coast situations requires a knowledge of the locality as well as of the soil into which it is proposed to plant them, for, of course, for particular situations some varieties of trees are much better adapted than others. This is particularly apparent in regard to indigenous trees; and in planting in island situations in such a climate as ours, it is essential, in the first instance, that none but indigenous varieties should be introduced. Indeed, in many positions, much may be done in commencing with mere shrubby plants or low bushes, so as to secure shelter at an early period of their introduction to the two-year-old seedlings and young hardwoods to be planted amongst them. For this purpose, as an outer belting, we recommend the hardy sea-buckthorn (*Hippophae rhamnoides*), the elder (*Sambucus nigra*), the tree mallow (*Lavatera arborea*), goat willow (*Salix caprea*), the alder (*Alnus glutinosa*), and the birch (*Betula alba*). As underwood shrubs, the snowberry (*Symphoricarpus racemosus*) and the evergreen barberry (*Berberis aquifolium*) are undoubtedly the most desirable, being both very beautiful whether in flower or in fruit, and at the same time thriving vigorously when planted amongst other trees in seaside situations. Whin and broom also form good undergrowth covering for exposed plantations in seaside positions, and in such localities serve also as nursing shelter to the hardwood young standard trees when newly planted. These may be reared at an early period in the history of such plantations by the seed being sown as soon as the belts are formed or the screens (if there be any) are erected.

Among the most suitable miscellaneous smaller trees and shrubs or bushes for island planting, for shelter as well as ornament amongst the more permanent trees intended for crop or profit in such situations, we may mention the hawthorn, lilac, mountain-ash, bird-cherry, Spiræa, Mahonia, holly, Arbor-vitæ, and Scotch rose, all of which thrive well when fairly established in such sites, and besides adding variety, contribute to the amenity of the young plantations by their individual acquisitions as flowering plants. One tree which is admirably suited for planting on island and coast situations must not be omitted from our list, and which is far too little cultivated in this country—namely, the evergreen oak (*Quercus ilex*).

For regular planting with a view to profit and for permanent timber purposes, we shall notice, first, the hard-wooded varieties; and secondly, the Coniferæ. Amongst the former, undoubtedly the best to withstand wind, and flourish under its exposure, is the sycamore, or as it is more generally called in Scotland, the plane (*Acer pseudo-platanus*). When once fairly rooted in its site it thrives, especially at first, under any protecting shelter, until it becomes established, and grows rapidly. Its branches and general habit of growth being "*twiggy*," this tree resists the gales with more impunity than any other description of forest-tree; and, in fact, it is curious that the plane is not more commonly and extensively planted in ordinary plantations on the mainland or hillsides, for besides standing up against the buffetings of wind in exposed situations, it forms a fine, dense, round head under any disadvantage of exposure. The plane-trees should be planted, if possible, in such localities as we are at present considering, in groups together. Several varieties of poplars may also be used as island trees and for exposed positions. Of these the most suitable is the grey poplar (*Populus alba-canescens*), which is certainly the hardiest of all the white poplars. The Canadian poplar is another suitable variety (*Populus candicans*). Being a native of Ontario in Western Canada, it is very hardy, and being of a more robust habit and growth than the balsam poplar, which it closely resembles, and attaining its full dimensions on reaching 40 feet in height, which it does in about twenty years, it is well adapted for thickening up plantations till slower-growing or more permanent trees are established. The alder is another hardwood well adapted for the purposes we have at present under consideration. Both descriptions may be recommended for such planting, *Alnus glutinosa,* and the hoary alder (*Alnus incana*). This tree is usually looked on as of little consequence as a timber tree; but this is quite an erroneous idea, for we have many recorded examples of the alder in damp ground and suitable positions attaining to great dimensions as a *tree,* being frequently found as large as 15 to 17 feet in circumference at 3 feet from the ground. When first planted it is tenacious of life, and from its rapid growth it is well adapted for being interspersed as a nurse in plantations in bleak and exposed situations, where it readily makes an appearance, and is an admirable protection to more valuable trees. The usual uses to which the alder is applied, is in making hurdle-wood or fagot-wood, as its capability of growing into a large tree and forming heavy timber does not seem to be generally recognised, or probably is not sufficiently known. In light sandy soils, or even in pure sand, the goat willow (*Salix caprea*) is a very desirable tree to plant. It may be used merely for the purpose of creating shelter, and in that capacity it is undoubtedly without a rival amongst deciduous trees. It may, however, be also utilised as undergrowth, and formed into hurdles, sheep-flakes, and similar articles, or, when grown taller, may be cut and manufactured into material for gunpowder, for which it is particularly adapted. Many other varieties of the willow tribe are suited for planting for shelter, one of the best and most rapid growers being the Huntingdon willow (*Salix alba*). There is probably no other tree which attains to such dimensions during the first thirty or forty years of its growth. Its trunk will in that time yield about one cubical foot for every year of its growth. It is a valuable coppice willow, and is the most generally planted willow as a timber tree in Scotland. Next to the alder and willows for island planting as a permanent tree we may mention the Norway maple (*Acer platanoides*); as a standard, the mountain-ash (*Pyrus aucuparia*); the birch, lime, ash, elm, will be found suitable for use as shelter in soil of good depth, and last of all, oak and beech. Such are the varieties of hard-wooded trees best adapted for planting for island shelter or as nurses, and to mix amongst young plantations in sea-coast planting. Of course it must be understood that while some descriptions of trees will be found to succeed better in one soil than in another, we have left the suitability and selection of the varieties of trees to be used to the judgment of the planter, assuming that he will select from amongst the species we have named such descriptions of trees as are best suited in their natural soils and situations to similar soils as exist in the island or exposed positions it is desired to reafforest or plant.

Amongst the Coniferæ found best adapted for planting with a view to withstand sea-breezes, or in exposed sites on islands, we may name *Pinus montana*, *P. pumilio*, *P. maritima* or *pinaster*, *P. austriaca*, *P. laricio*, and the common Scots fir (*P. sylvestris*), of the true *native* variety. Where the soil is deep, or where it has been trenched as already referred to, the silver fir (*Picea pectinata*) or *P. Nordmanniana* may be planted. The least suitable for exposed planting is the spruce (*Abies excelsa*). Even the Norway variety, although it does better, is too shallow-rooted to resist the prevailing winds, unless well protected amongst a dense plantation. In well-drained ground the larch may be introduced with advantage, and either planted alone in a large and well-drained area of considerable expanse, with good sloping exposure and altitude, or intermixed with *Pinus laricio* or *P. sylvestris*, or both in equal quantities, in large masses or sheltering belts. One considerable element in successful planting on exposed island and similar situations, consists no less in the careful selection and preparation of site, trenching, and forming screen wind-brakes, than in the selection of young trees which have been properly trained from their earliest years for such situations, and reared so as to produce strong fibrous rootlets to induce them to take quick hold in the exposed sites for which they are intended. For all island planting, and where the plantations are meant to be in masses or broad strips, the coniferous trees which form the great bulk of the planting should always be grown from the best seed of the native varieties where practicable, and the plants used should be two or three years old, transplanted into nursery lines, the year before they are introduced into the plantation for their permanent situation; and they should be planted at least about 2½ feet apart at first for the general crop, including nurses, hard-wooded varieties being planted according to the descriptions used, at allotted distances, or according to the nature and aspect of the ground planted, its altitude and surroundings.

Having thus specified the varieties of trees best suited for planting for shelter in our islands, and noticed the special situations and nature of the soils to which some trees named are more particularly adapted, we may, before concluding this paper, mention the time of the year best suited for maritime planting, and mode most usually followed with advantage. In such situations as we have been discussing, the operation of planting or forming seaside plantations is necessarily attended with a good deal of risk, and at the best is a difficult process, and requiring both care and attention in every detail to ensure successful results even under favourable circumstances: the season of the year, therefore, for committing the young trees to their new locality is a most important consideration. From considerable experience and observation, we think that the spring of the year, just before the plants begin their season's growth, is invariably the proper season. According to exposure and situation, from the end of March or beginning of April is usually, in ordinary seasons, a very suitable time. Although some foresters advocate autumn or winter planting—and no doubt in some sheltered positions and in good soil the last weeks of October are found to suit very well—still in the event of a very severe or extreme winter the young trees newly planted, and not having had time to take hold of the soil or become accustomed to the site, are apt to be thrown out, and the small rootlets which they may have been able to form are still quite insufficient to support them during the trying winter months, and the young spongioles just formed are too tender to resist the frost or cold winds that may attack them during the severity of the ensuing winter. It is much better to leave them still in the nursery, and plant them out about the end of March if the weather be open and seasonable, so that they may start away with their spring growth, and thus avoid at the very beginning of their acclimatisation the effects of winter. Should there be, as may be almost surely expected, a succession of wet weather in April, the planting we have recommended, especially if in sandy soil, will generally prove highly successful, as the young trees lose no time in fixing their rootlets in the ground, and thus start their first growth in their new site with the calmest months of the year, enabling them to acquire a full season's growth, and to ripen their young shoots before the effects of the winter are felt by them in their new situations.

There is a very appreciable difference between the influence exercised by the climate and situation on exposed plantations on the east and northern coasts of Scotland, and upon those on the western shores. Along the coasts of the western islands, where much planting in all sorts of soils and exposures has been, during recent years, carried out or attempted, the beneficial effects of the Gulf Stream are felt in no small degree, and its influence in ameliorating the climate during winter in these parts is very perceptible. This is so marked, that it is well known that in many places along the west coast of Scotland, many trees and shrubs, usually considered only half hardy when planted near the sea-breeze influence, thrive in these localities with perfect vigour and hardihood. Much, no doubt, depends also upon the soil and its depth in which they grow, but the progress made in many such situations, equals that attained by the same species in sheltered inland positions. Considerable advance has been made in clothing with healthy woodland the western coasts and islands of Scotland, as in the island of Skye, at Morinish in Mull, and by many proprietors owning large areas along these shores. We have only further to notice the efforts made by General Burroughs in the Orkney Islands to show what patient assiduity and intelligent foresight may do, and to hope for more and greater achievements in the culture of home timber under such difficulties, by judicious planting and treatment, according to the requirements of the respective localities. Whether or not in such positions and in such soils as they are frequently placed, in such disadvantageous and unpromising sites, trees may ever become valuable as timber, is a problem which only future years, and laborious and persistent assiduity, can solve. That they will grow and be useful for many purposes, such as palings and other country requirements, there is no reason to doubt; and perhaps, after all, they may attain one great end and anticipation which their planters had in view, in the shelter and ornament they afford, and in the clothed and improved appearance they give to what a few years ago many a neighbour may remember as a very dreary prospect. That such a change may be effected in many a barren spot around our Scottish coasts and islands is earnestly to be hoped for, and that the experience which such proprietors may obtain after so much expense and personal trouble may be amply rewarded is much to be desired, so that others also may be led to follow their example, and convert what are at present bare and sterile tracts into well-clothed, useful, and remunerative lands.

TRAWL-NET FISHING: ITS EFFECT ON MARINE LIFE.

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[Premium—*Five Sovereigns.*]

The subject of beam-trawling in connection with the economy of our Scottish fisheries has of late been largely discussed, much having been said *pro* and *con.* Taking for granted that the essay desired by the Highland and Agricultural Society is wanted for the purpose of disseminating correct information regarding that mode of fishing, the following observations are offered in the hope that they may prove useful in setting aside prejudice, and showing that without the use of the beam-trawl net the supply of fish obtained would be utterly inadequate to the wants of the people, and fish become, in consequence, so high in price as to place this wholesome article of diet in that category of table luxuries which only rich people are able to purchase.

The saying of Mr Huxley, that "it is of no consequence when you fish, how you fish, or where you fish," is founded on the fact of fishes being so liberally endowed by nature with power to multiply their kind. The members of the cod-fish family, for instance, have been bountifully endowed with the power of reproduction. The ova of various of these fishes carefully counted has been found to number millions: in one or two instances as many as 7,000,000 have been extracted from a female cod-fish. Other members of the Gadidæ family, in proportion to their size and weight, are equally well gifted with the power of reproduction. It is, therefore, not difficult to prophesy that a few hundreds of these fishes (male and female, of course) could reproduce their kind in such quantities as would afford many pounds' weight of grateful food to each unit of the consuming population. The haddock, also, is a fish which is provided with wonderful powers of reproduction, whilst the fertility of the sole (and the minor members of the flat-fish family) has been again and again demonstrated. As for the turbot, scarce as it is and dear as it has become, it has been given the power of reproducing its kind even more abundantly than the cod-fish, as many as 15,000,000 of eggs having been extracted from one female turbot! The conger-eel, which is rarely offered for sale, surpasses all other fishes in reproductive power, each female containing "millions upon millions" of ova. So at least the world was told by the late Mr Frank Buckland. That delightful table fish the salmon, as is well known, has been endowed with a supply of ova equal to 800 for each pound of its weight. The herring is also very fecund, yielding, according to its dimensions, from eighteen to forty thousand ova.

There is, of course, a *per contra* to this abundant spawning power of the food fishes. Millions of the eggs never yield fish, being devoured by enemies; and of the fishes which do result, hundreds of thousands are annually added to the bills of mortality long before they become fit for the table. As regards the herring, "tons of spawn" go to waste during the fishing season, it being a feature of that branch of fishery industry to capture only (when that is possible) fish which are full of spawning material—a condition of herring-capture being that only "full fish" are eligible for the highest brand.

In the face of this wealth of ova, Professor Huxley's contention looks reasonable enough—"It is no matter where you fish, when you fish, or how you fish." But despite that gentleman's deliverance, many people are possessed with one idea about the proper mode of fishing for sea-fish: it is, "they ought to be caught by means of hooks only, baited with some substance that will prove attractive to animals sought to be captured."

That denotes a very old-fashioned way of fish-catching, which, till a few years ago, was in Scotland the only mode adopted by the fishermen: to take "big" fish by means of hook and line was a matter of "use and wont," and the fathers and grandfathers of the present race of toilers of the sea, it is pretty certain, never thought of such a mode being superseded—just as the weavers of old never dreamt of the "power loom," or of that wealth of machinery which, in the production of textile fabrics, has long since superseded hand-labour. Another example of industrial change may be cited: it is found in the steam printing-machine of to-day, which some sixty years since began to take the place of the old labour requiring hand-presses. Bait-fishing has enjoyed a long day; and although some among the present generation of fishermen may fish with lines and hooks as long as they are able to handle that kind of gear, capturing fish in that old-fashioned way is probably doomed.

"Line-fishing" by means of bait is an expensive way of obtaining fish—the expenditure necessary is gradually increasing, and the time expended in fixing bait on the hooks is an important factor of the industry. The "bait" itself (mussels are more especially referred to) has during the last ten years become much less plentiful, and in many instances has to be "boated," or brought long distances by means of the railway. At one period mussels were so plentiful as to be found in proximity to nearly every Scottish fishing village, and whilst "the men" were absent on one fishing voyage, their wives and children were easily able to collect the required quantity of bait for their next venture. And never thinking for a moment that the local mussel-beds, from which they drew their supplies of bait, would in a short time be reduced below the reproductive level, they continued to gather these molluscs till, in time, they were forced to realise the great fact that they had exhausted them—that they had, in short, "killed the goose for the sake of its golden egg," so that now they have to purchase their bait from persons who possess beds which they are careful to protect, and do not allow to be "over-fished."

The cost of bait, then, is an item of expenditure in line-fishing which, in time, fishermen will not easily be able to meet, and, in consequence, will prevent their competing with men who do not require to purchase mussels or other bait, nor expend valuable time in placing it upon their hooks, only, in many instances, to be eaten by fish they do not catch. Of late years, a vast amount of sentiment has been evoked, chiefly by the aid of political agitators, in favour of the "poor line-fishermen," who are made to appear ill-used, while as a matter of fact they are simply being left behind in the great industrial war which is now being waged both on sea and land—a consequence, in some degree, of their own want of enterprise and lack of means with which to fight their opponents who have launched trawling vessels upon the fish-laden waters.

It is a curious circumstance in connection with the "spate of sentiment" recently evoked in favour of the line-fishermen, that the case of the general public, who in reality have most at stake, is never considered. Hitherto, most of what has been said has been on behalf of the "lines-men," who seem to be looked upon as lords of the fisheries, "masters of the sea." But what the food-eating community desire is a larger and more constant supply of cheap fish; and were there no other means of capture than line-fishing, the public could not possibly obtain that—not even if the number of line-fishers was quadrupled. Were the national commissariat now to be dependent on that mode of catching fish only, the supply desired would not meet the demand, whilst prices would undoubtedly be much in excess of those now paid, dear as most kinds of fish are thought at present to be.

In the opinion of the present writer "the trawl is undoubtedly the instrument that is best adapted for the capture of all ground-feeding fish: that it also encloses in its ponderous jaws cod and haddock, is a circumstance or feature of the industry which cannot be avoided; moreover, trawl-fishing is undoubtedly the quickest and cheapest mode of fishing that has yet been devised."

In trawl-fishing there is no bait required, consequently no time requires to be expended in baiting hooks; and the fact of trawling vessels (in Scotland) being impelled by steam-power, renders it possible for them to reach and run over fishing-grounds with greater rapidity than the sailing boats of the line-men can ever attain: a trawler, steam propelled, can, as a rule, make three (certainly two) voyages whilst a line-boat makes one. The beam-trawl net is undoubtedly a most formidable engine of fish-capture. As it is "trailed" along the sea-bottom, almost no living thing coming within reach can escape being engulfed within its capacious jaws. Many kinds of fish are, in consequence, captured—round fish (that is, cod, ling, and haddock), as well as ground-living or flat fish.

Although beam-trawling is what may be called a new mode of fishing in Scotland, it has been for very many years a well-known plan of capturing fish on the English coast, as also in the North Sea, where no objection has at any time been made to it. It is chiefly in the Scottish fisheries that steam-power has been invoked on behalf of these fishing-craft, which are pretty certain to increase, seeing that at the present time there is found a ready market for all fish caught, whilst a still greater quantity would command ready sale.

Sentiment being excluded from the argument, it cannot be made too public that line-fishing can never be profitably pursued in competition with trawling. There is one factor in that method of fishing which of itself presents a serious obstacle to its success,—it is the vast percentage of bait that from some cause or other is unproductive. If each hook baited were to capture a cod or other fish, the supply from such a large fleet as is now engaged in line-fishing would be very considerable; but in practice it is found that not one hook in five takes a fish. The crew of a North Sea cod-fishing vessel will have as many as 4680 baited hooks in use, but these will not, as a rule, give them 1000 fish; and even if such a number could be relied upon, the labour of baiting them and then placing them in the water would not be exceedingly well rewarded. The mere fact of such an enormous number of hooks being used is of itself proof that only a small percentage of fish is likely to be taken. At one period in the history of cod-fishing, a much smaller number of hooks were baited, and more fish were obtained by each crew than are now captured; but it must be kept in mind that the fishing fleet has increased enormously, so that although sea-fish are probably as plentiful as ever they were, it is only reasonable to compute that three crews will not capture more than the two crews of say forty years since.

It now becomes necessary to consider the evil that is done by the trawl. In the course of the bitter controversies which have originated in considering the case, and advocating the cause, of the "poor line-fishermen," it has been suggested that trawling is a very uneconomic method of capturing fish, and the suggestion is founded on fact to some extent; but no mode of fishing yet discovered can be passed over without criticism, nor is there a plan which can be considered perfect as respects the capture of a fish at the moment it becomes of its greatest value as food, and is of the least value as a reproductive agent. All modes are more or less "hashy," and countless thousands of fish are annually captured just at the time they are of the least food value, but at the period when they are exceedingly precious because of being filled with their spawning matter. Even the line-fishermen pursue their avocation when the fish they are in search of are engaged in repeating the story of their birth; and although those captured are alive when taken off the hooks, they are not restored to the waters from whence they have been lifted, but are eagerly seized and in due time offered to purchasers. These gravid fish, it may be here observed, are in the worst possible condition for food, all their fat-forming properties being at that time requisitioned to aid the formation of the spawning matter. It is a fact in fishery economy that every spring there is offered for sale throughout the country "literal hundredweights" of fish ova—milts and roes. As Mr Buckland once said to the writer in a London fishmonger's shop, where a great supply of fish spawn was on exhibition,—"Behold, there you have an incalculable number of what might have been three or four years hence table fishes, and of wonderful value as a contribution to our food resources—as we see them, we can eat, when the roe comes to table as an *entrée*, a thousand or so at each mouthful: why should men be permitted to capture fish when they are just about to spawn?" Why, indeed, except that throughout all time it has been a matter of "use and wont" to do so, and "use and wont" has been constituted guardian of our fisheries.

The beam-trawl, it must be honestly admitted, is not more responsible for the capture of gravid fish than the baited hook; indeed it is in reality less responsible for the destruction of spawning material, inasmuch as the greater portion of the fish captured are dead before they can be released from the net, and cannot therefore be again restored to the water; but fish which are taken alive, especially fish about to spawn, ought to be at once thrown overboard and allowed a chance of multiplying their kind, and that for two reasons: first, because when in the condition described they are unwholesome and unfit for food; and second, because of the addition their eggs, if hatched, would make to the general fish supply. The beam-trawl (the writer here speaks of what he has witnessed at Great Grimsby) must be held responsible for the capture of immense numbers of immature fish of all kinds—thousands upon thousands of many sorts of small fry being crushed to death in the trawl by the weight of those larger fish which are captured. If the meshes of the "cod-end" of these nets were enlarged, it would give the fry a chance of escape; and as they are of no market value, there seems no reason why the meshes should not be considerably enlarged. It is mature fish the public desire, whether cod or turbot. The beam-trawl net is undoubtedly responsible for much damage to the larger kinds of marine life; but to say that fish which have been caught by a trawl net are not so fit for table use as those caught by line is nonsense. After a cod-fish has been manipulated by the cook, and makes its appearance in the dining-room, there will probably be no person present at table who is able to say whether that particular denizen of the deep has been hooked or trawled.

Another "theory" advanced on behalf of line-fishermen has been adopted by some political agitators, who have found it a congenial theme—namely, that the beam-trawl net destroyed the spawn of many kinds of fish; but all who possess even rudimentary knowledge of fishery economy, know well that the trawl net, as a rule, does nothing of the kind. A trawl net can only be worked over a sandy or muddy bottom, and on such ground no spawn is deposited. As a matter of fact, the ova of most of our food fishes (certainly of the larger round fish) floats upon the surface of the sea, and as the waters are wide and the trawl is small, any damage done is infinitesimal. As to the allegation made of damage to the spawning-beds of the herring, it may be replied that herring deposit their eggs on rocky or stony surfaces, which all prudent masters of trawling vessels carefully avoid. Our herring supplies, notwithstanding the constant waste incidental to the capture of that fish, are not diminishing, as an examination of the reports of the Scottish Fishery Board will at once convince any impartial inquirer, so that it may be held as proved the trawl net has done no evil in connection with the herring supply.

During the last four or five years it has been stated by friends of the bait-fishers, that trawling was rapidly decreasing the supplies of fish; but no proof has been offered of the fact; on the contrary, figures have been presented to show, and have shown, that fish are not less but rather more plentiful now than they were about the date indicated. The old saying, that the same figures will prove any side of a question, will apply in this case; but all who take trouble enough to inquire, are sure to find, as the writer has found, that figures used for the purposes of political agitation must be taken with a very considerable allowance of salt. It has been demonstrated by trustworthy persons, that at some ports the line-fishermen have been even more prosperous since trawling began than they were before. It is hardly possible that the Scottish trawling fleet can have done all the damage attributed to it. Fishing-grounds that were said, a few years since, to have been rendered barren, are to-day, so far as it is possible to ascertain, as populous with the finny tribe as ever they were. And it has been shown that line-fishermen are as keen to fill their boats as trawl-fishermen are, no matter what the condition of the fish captured may be.[1]

In the face of what has been said by Mr Huxley, it becomes a question as to whether any restrictions should be placed on the trawlers, except, of course, as "a matter of police." It must be admitted on all hands that the fisheries ought to be "regulated," and that if damage be done by trawlers to the fishing-gear of the liners, compensation certainly ought to follow. But at the same time, it ought to be distinctly laid down as law that the sea is free to all, and that no man, or body of men, has a vested interest (other than for the general good) in the food-supplies of which it is the never-ceasing source. In reality the sea and its treasures are too accessible: all who please can go down to the waters, and, dipping their nets in them, carry away whatever they can catch. No fisherman is asked to pay one penny of rent, or to provide breeding stock. No cultivation is required, no licence fee is exacted, and yet there are

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[1] The following figures, relating to the capture of four of the larger food fishes in Scottish waters, are from returns issued by the Board of Trade:—

	1889. Cwt.	1888. Cwt.	1887. Cwt.
Cod . .	504,015	449,977	383,089
Ling . .	134,470	129,776	100,593
Haddock .	789,473	821,067	751,474
Halibut .	20,944	20,198	18,992

The above statements must not be taken for more than they are worth, as no two fishery seasons are ever the same in respect of weather influences, which, of course, exercise very great power in all matters relating to the capture of sea-fish.

thousands who are discontented, and who are asking that they alone should be allowed to gather the valuable piscine harvest yielded by the waters of the great deep. It is impossible, however, to consider the situation in which the line-fishers find themselves without feeling much sympathy for them. They are being left behind in the industrial race. The men are too poor to provide themselves with the steam-trawling machinery which at present is carrying all before it, and they are encumbered with their old-time fishing-gear of long and short lines. Many of the men, too, have passed the period of enterprise, and are somewhat benumbed by the frosts of age, so that it is vain to expect them to enter into active competition with companies fostering the new mode of fishing. It is useless to blink the fact that trawling denotes that plan of fishing which is least expensive, which is most expeditious, and which provides the public with fish at a price within the means of nearly every individual of the purchasing population.

CHANGE IN CROPPING TO SUIT ALTERED CONDITIONS OF FARMING.

By JOHN SPEIR, Newton Farm, Newton, Glasgow.

To be able to introduce into Scotland any new rotation of cropping, without also introducing a new crop, will to many appear quixotic and very unlikely, because most crops, in almost every conceivable rotation, have in years past been put to the test of practical experience, and only those have been retained which experience has proved to be suitable for the situation and climate. No new plants are herein offered as being suitable for ordinary farm cultivation, and no new rotations are submitted which will be applicable to the whole country, but a few combinations are suggested which have not only been *tried*, but have been successfully carried through in the seaboard parishes of the southern half of the country, but which the general farmer knows very little about. Although these combinations of crops have hitherto been confined to a few coast farms in early localities, the same systems, or some modifications of those here enumerated, may shortly be found suitable for a much more extended area. Where market-garden crops are cultivated, many combinations or rotations of crops can be successfully grown, which cannot be attempted in ordinary farming. The bulk of those, however, here suggested, may be looked on as usual farm crops, and may be grown on any ordinary farm in the best climates of the southern half of the country.

I. Early potatoes (boxed), to be followed by rape, Italian ryegrass, thousand-headed kale, rye, or savoy cabbages.

This is the rotation, or at least part of a rotation, which is followed largely on the earlier farms along the Ayrshire and Wigtownshire coasts, and to a lesser extent round all the Firth of Clyde. To be able to attain the best results, the very earliest varieties of potatoes must alone be used, and these must be grown on the box system. For this purpose the seed potatoes (medium-sized ones being preferred) are kept in boxes, instead of pits or clamps, during the winter. The boxes may be of any size, not over 3 or 4 inches deep, the size in common use being 30 inches by 18 by 3, with a handle at each end. Upright pieces are nailed in each corner, with another piece across the end from the top of these corner pieces, which serves the double purpose of being used as a handle, and forming a suitable foundation for another box to sit on the top, as during the winter these boxes, when filled with potatoes, are piled the one on the top of the other to almost any height. These boxes generally hold from 3 to 4 stones of potatoes, from 30 to 50 being generally sufficient to plant an acre. The seed potatoes are put in the boxes at digging-time, whenever that may be. Some are used as early as the latter half of July in a good early year like 1887, and others may not be put in till the usual time of digging in October. The potatoes are emptied into the boxes indiscriminately, from two to three deep, the boxes being then stored the one on the top of the other in any outbuilding fairly secure from frost. On the joists of cattle-sheds not too close and warm, tons above tons may be placed, and any other buildings which in themselves are not frost-proof, may be rendered so by the addition of a stove or warm-water pipes. In this way cheese-rooms and other apartments above kitchens, or other places where fires are kept on, are often utilised in the dead of winter. For sound-grown potatoes, very little heat is required, if frost only be kept off; and where there is a risk of it coming through the slates, it is well to cover the top row of boxes with old bags.

By the time all danger of frost is past, each potato will, as a rule, have one sprout from 3 to 6 inches long, which should be of a blue slate colour. Where there is too much heat, too little light, or any damp getting in, there is a danger of the sprouts becoming white and brittle, whereas if they retain the blue colour, they are quite tough and rarely break. If the potatoes have been late in ripening or in being boxed, and are not sprouting freely, darkness, a little extra heat, with a little sand sprinkled over each box, is a great inducement for them to break freely. Under such circumstances, however, it is advisable to thoroughly expose them to the light a week or ten days previous to planting, in order that the sprouts may become toughened. At planting-time drills are opened from 21 to 24 inches wide, by the plough in the ordinary way, and the plants set in the bottom, to be thereafter covered up by the plough as usual. If growth is, however, near at hand, and the seed is well sprouted, nothing is to be gained and much may be lost by covering them with much earth. In a genial spring they will show themselves in the rows in a very few days, and thereafter, under judicious and liberal manuring, grow amazingly. At present all the earliest potatoes in Ayrshire, Wigtown, Arran, Bute, Argyle, and Dumbarton, are grown in this way, several farmers having as many as 100 acres and over, planted all from boxes. The boxes with the potatoes in them are carted to the field and distributed along the side of the newly opened drills; and while one person removes them from the boxes with short-handled flat shovels or scoops, women and boys plant them by carrying the shovel or scoop in one hand, and transferring the sets from it to the drill with the other. The after cultivation of the crop is that usually given to potatoes, and in consequence of the treatment the seed has received, tubers will be formed from two to three weeks earlier than the same variety planted in the usual way. The varieties most in use are Don, Sutton's Early Regent, Beauty of Hebron, and Red Bog.

Grown in this way the crop will be ready to raise from the last week in June forward, according to the year, situation, variety used, and treatment given. If the crop is very early, the land may be planted with full-sized stubby-grown savoy cabbage plants as the digging proceeds, or if thought advisable a second crop of potatoes may be taken, by using early varieties, and having them well sprouted previously. In any ordinary season this may be done up to the beginning of July with fair prospects of success.

After that date, or before it if thought advisable, turnips may be sown—the earlier-bulbing varieties for preference being used, such as Golden Stone or Golden Ball. As the land on which the earliest potatoes are grown is usually very sandy, and the raising is always done at a very dry time of the year, it is advisable to have the seed sown as soon as possible after the potatoes are dug—that day, in fact, if at all convenient—so that all the natural moisture of the soil may be retained in order to hasten the germination and growth of the turnip crop.

Good-sized bulbs, very regular in shape and about the size of a man's two fists closed, can quite readily be obtained where the cultivation, season, and manuring are anything like favourable. These roots stand the frost fairly well; and in the West Kilbride district of Ayrshire from fifteen to twenty years ago, a large area of this crop was allowed to stand throughout the winter and used the following summer for growing a crop of seed. At that time digging was not possible so early as it is now, owing to the new system here described and the introduction of earlier varieties; so that what was possible then should be much easier now, as our knowledge of the principles of manuring has made considerable strides since then, leaving out of account other aids already mentioned.

Instead of turnips, thousand-headed kale or rape may be grown—the former to be used as spring food and the latter as autumn feed for sheep. If rape is sown, it is usual to do so before the potatoes are dug—so many drills a-day being sown broadcast over the top of the potatoes, the digging of which spreads and covers the rape-seed in a surprisingly regular manner. All, then, that is necessary after the crop is removed is to give the land a slight harrowing, which even in many cases is dispensed with. The feed yielded by a good crop of rape on well-manured land is often something considerable, and the soil is, besides, left in very good condition for the following crop, which may be anything suitable.

Owing to excessive cropping with cruciferous plants, many farms are liable to have the crops of turnips or rape after early potatoes affected with club or finger-and-toe, in which case it is better to substitute for them Italian rye-grass. If this be sown at once when the land is moist, and be carefully covered and rolled, it soon brairds, and by autumn yields a heavy growth of fresh succulent herbage. This crop may be used for hay the season following, or, if thought necessary, may be ploughed down again. It must be remembered that to crop in this way one must not be tied down by the old-fashioned clauses of many leases binding the tenant to do this, that, and the other thing, as if the drawer of it knew farming better than those who had spent probably a lifetime in learning their business. The Ayrshire coast farmers throw all these clauses to the wind, and in some cases have cropped potatoes after potatoes, and potatoes and hay, or potatoes and barley, for twenty or more years in succession, with the best results to both themselves, their landlords, and their farms. Of course to do so manure must be used with no stinted hand, and cases are quite common where our greatest chemists have been consulted regarding the quantities of certain manures which should be used under such circumstances, in which the chemist recommended half the quantities the farmers had through experience found to give the most profitable results, whereas in the ordinary cases the chemist cannot get the average farmer to give much over half the amount of manure he thinks is necessary to give a full crop.

If the land so cropped is near a railway station, or easy of access to any of the large towns, winter greens or curled kail may be grown after early potatoes with the very best pecuniary results. Like savoys, the plants should of course be prepared beforehand, and be planted as soon after digging the potatoes as possible. In planting such crops as kail or savoys, if the land is very dry, it may be necessary to water each plant. This had to be done extensively in 1887, although as a rule it is too seldom necessary in Scotland. Before planting, it is a good plan to dip the roots of the plants in a puddle composed of equal bulks of clay, cow-manure, and guano. This mixture has the effect of causing the plant to root readily, stimulating it, and preventing it from flagging. Considerable flagging is also saved if during sunny weather planting be delayed till mid-afternoon or evening. In ordinary seasons kail or savoys got in in time will yield during winter and early spring a return equal to an ordinary potato crop. In districts having an early climate and mild winter, but lacking communication for sending such to market, the same money return cannot of course be made out of the crop, but for sheep-feed in early spring they will come in very useful.

The place in the rotation for early potatoes grown as already described, is generally after a grain or hay crop. In many cases the rotation is a three-course one of potatoes and turnip, rape, Italian, &c., the first year, grain the second year, and hay the third year. On one or two particular farms, where early potatoes are grown, and where the extent of suitable land is limited, the rotation is completed in two years, being the first year early potatoes, with turnip, rape, Italian, mustard, &c., and grain, generally barley or oats, the second year, the hay crop in the previous rotation being dropped out. In a great many other cases the ordinary four-course rotation is in use, while in some it is extended to five, six, or even seven years, by taking one, two, or three years' pasture after the hay.

The manure used is generally principally applied to the potato crop, and consists of about 20 tons of farmyard manure, or sea-weed, spread in autumn or winter, and ploughed in, and from 10 to 15 cwt. and even 20 cwt. per acre of artificials sown in the drill. These artificials consist of manures yielding equal weights of potash and phosphoric acid, to which is added various nitrogenous manures yielding nitrogen equal to from 5 cwt. to 10 cwt. of nitrate of soda per acre. To many these quantities will no doubt seem ridiculously excessive; but when it is remembered that the growing season of the potato crop is so short, and the crop when early and ready to dig often sells at from £27 to £35 per imperial acre as it stands, the farmer only doing the carting, it is seen that every inducement is given to full manuring. The rainfall also being comparatively light after the crop is planted, there is not the loss of nitrogenous manuring many would suppose, although I have no doubt in some seasons it is excessive. The green crop following the potatoes never gets any manure, and it will only be in exceptional cases that the grain and hay crops will require any either.

II. Winter tares and rye, with potatoes or turnips after.

In the earliest and mildest districts of the south and east of Scotland, winter tares stand moderately well, and rye may be always calculated on doing so. The crop may be sown after a grain or other crop which leaves the land clear in September, and if sown about the middle or latter end of the month, the produce may be cut green from the latter end of May forward, according to season and climate. If the land is immediately ploughed and manured, and then planted with boxed potatoes of any of the earlier varieties, there will be no difficulty in getting a moderate crop in any average season. Potatoes may be so planted up to about the beginning of July, at or before which time the rye should be all consumed, as it then has become too hard to be used as green food.

This crop of tares and rye, singly or together, comes in very handy for summer soiling; and should the season or circumstances of the farm render green food so plentiful at that time that the tares and rye are not required, the crop may then profitably be put into the silo for preservation to the following winter or spring. By so doing, the land can probably be cleared more speedily of its crop than if it was being consumed as it was cut, — the cutting being done at the time when the crop was in the best condition for doing so.

The potatoes to be used do not require to be boxed before the New Year, and boxing may in an average winter of cold be delayed till February, while in a very cold one, boxing might be put off till March. In boxing, all that is necessary is that the potatoes be put in the boxes before their sprouts have become long enough to be damaged or broken in dressing. If at all possible, it is preferable they should be put in the boxes just at the time *when the eyes have begun to break*. By so doing sprouting is delayed to the greatest limit possible, which is the aim it is desired to attain by boxing in this case, because if the tubers were left longer in the pits, they would begin to sprout and unnecessarily exhaust themselves, and cause the produce to be later in ripening. It will thus be seen that, although the same system of boxing is here used as where a very early crop of potatoes is desired, yet it is done for exactly the opposite reason; for, in the latter case, boxing is done for the purpose of hastening the growth of the tubers, while in this one it is done to *retard it in the first place*, and secondly, to *hasten the maturing of the crop.* Full-sized potatoes will remain alive for eighteen months after digging, if kept in shallow trays or boxes, dry, cold, and exposed to light. The drying process to which the tubers are subjected while in the boxes, apparently has this effect. In horticulture and floriculture it is well known that all or most plants which are used for forcing in order to obtain an early crop, must generally rest a certain time before germination will begin, no matter what heat or moisture they are subjected to. For instance, among fruits, vines will not start till their usual period of rest has elapsed; among vegetables, neither will rhubarb nor seakale; and among flowers, bulbs, such as hyacinths, tulips, narcissi, &c., and plants, such as spiræas, dielytras, &c. The period of drying to which the potato is subjected appears to alter the constitution of the tuber considerably from what it would have been had the tubers been kept moist, as in the pit during winter. These facts have as yet not been proved beyond the possibility of a doubt, but as far as my information and experience go they appear to be correct.

In the year 1888 I planted potatoes on 30th of June, and again on 10th of July, and notwithstanding the cold wet summer, the first lot were touching in the drills (26-inch drills) five weeks from the day of planting, and the second lot in a few days more. The first lot commenced to lose their leaves about the middle of September, and the leaves were all off by the end of the month. The first planting consisted of Dons, Sutton's Regents, and what in Fifeshire and the east coast are known as White Dons. The last is considerably the latest in ripening, the others in the order in which named.

The second planting consisted of Beauty of Hebrons and Sutton's Regents. The former ripened much the earlier of the two, but the latter had the largest crop.

It is not by any means advocated that a crop grown in this manner will be good for table use, but if fairly ripened they should make good seed; and if such can be grown in a season like 1888, much better results may be obtained in an average one.

Both crops, which had been planted on 30th June and 10th

July respectively, were dug on 16th October. The shaws of the Beauty of Hebrons had completely disappeared two or three weeks previous. Don (West Country) had also its shaws apparently ripe a couple of weeks previously. The Sutton's Regents planted on 30th June were quite dead, while those planted on 10th of July had been quite green, and growing until killed by frost about ten days before; while the East Country Don, although much the latest variety, was also fairly ripened and the shaws dead. It was planted on 30th June. Sutton's Regent appeared to be the heaviest crop, or about 6 tons per acre, everything included. East Country Don came next, with about 5½ tons. West Country Don had about 5 tons, and Beauty of Hebron last, with about 4½ tons.

Sutton's Regent had the largest proportion of small, Beauty of Hebron next, then East Country Don, and lastly West Country Don. Sutton's Regent has always a large proportion of small, and West Country Don very little small; so that under the present circumstances each apparently keeps its relative position. In this test fully half an imperial acre was planted with Sutton's Regents, about half an acre with West Country Don, fully half a rood with East Country Don, and a few poles with Beauty of Hebron.

All had only a very little disease, from 2 to 3 per cent, Beauty of Hebron and West Country Don being much the worst.

During 1889 I planted about 3 acres of potatoes after winter rye and vetches, and 1 acre after spring vetches. Early in May a good cut was obtained from the most forward acre of the winter rye and vetches, and on 25th June another smaller cut was again obtained. This cut was composed principally—I might almost say entirely—of rye, as it starts into growth again much quicker than the vetches. Both will grow and live after being cut, if the cutting is done before either plant has attained anything like maturity; after that neither will live.

The first planting of potatoes was made on 10th of June, the seed of this and all the other plantings being sprouted as previously described. As the previous crop had drawn very considerably on the stock of moisture in the soil, and as little rain had fallen for some time, the land when ploughed up was almost free from moisture. At the time of making the other June plantings—viz., on the 20th and 29th—the land was in the same dry powdery condition, very hard to plough, but easily broken up afterwards. It almost seemed foolish to plant potatoes in such a soil, but I thought if they could live and sprout in the boxes, they at least would not die if they did not make much growth, and there was always a likelihood of rain coming on soon. Contrary, however, to expectation, they were through the ground in about a week, and continued to grow steadily on all the time, although no rain fell till 9th July, by which time they were well covering the drill. The drills this year were from 26 inches to 27 inches wide, and they were regularly touching in the drill at between the sixth and seventh week from the date of planting. After the rain on 9th July, all the lots grew much quicker, and from the time they were ready to weed it was a surprisingly short time till each drill touched its neighbour.

The acre of spring-sown vetches turned out an extraordinary heavy crop, and that, combined with the plentiful supply of pasture, caused them to last fully longer than I had anticipated; so that the crop was only cleared on 15th July, the land ploughed, and the new crop of potatoes planted on the day following. In every case the manure used was farmyard manure, principally well-rotted stable manure, the whole being spread in the drill, and no artificials used; my reason for using farmyard manure being that, when moderately well rotted and wetted, it keeps its moisture for a very long time. The feeding fibres of early varieties of potatoes also spread so little through the soil, that unless they get their food within easy limit they do very little good. Frost came on in the middle of September, severe enough to kill potatoes, nasturtiums, and dahlias, at which time the lot planted on 29th of June were green but fairly well grown, while those planted on 16th July had not yet met in the drill, the others being by this time quite ripe.

All were lifted on 17th October, selected, weighed, and the land measured. The last-planted ones contained few potatoes 2 inches in diameter, and the whole acre did not yield any more potatoes than had been used in planting it, so that it was a complete failure. Somehow or other this plot never looked well; it did not come away as the others did, and although only six days later in planting than the last planted ones last year, still it never looked nearly so healthy as they did, even although the general summer temperature was higher this year than last. Other persons who have been planting potatoes as late as the middle of July have had similar results, so that I expect (without knowing) that the August and September temperature of 1889 was lower than that of 1888, although the latter, as a whole season, was much colder than the former. Another thing which bears me out in this surmise is that this year all the early ripening varieties of potatoes are an immense crop, while the latest ones, like Champions, are very poor; on the other hand, the positions were quite reversed in 1888.

No separate note was kept of the yield of the areas planted on the 10th, 20th, and 29th June—all being emptied together and dressed. The total land, however, under crop planted in June was measured, and found to contain 2 acres 3 roods 20 poles, and yielded the following quantities of potatoes:—

	Tons.
Over 2¼ inches in diameter	4
Over 1¼ inch and under 2¼ inches in diameter	11½
Over 1 inch " 1¼ inch "	½
Small, diseased, and damaged ones	½
Total	16½

Judging from the appearance of the crop when thrown out by the digger, and the actual weight known to have been produced by the whole area, I would estimate the different plantings to have a produce something like the following—everything being calculated:—

	Tons.
Potatoes planted 10th June, per imperial acre	7
" 20 " "	5½
" 29 " "	4

The proportion of small-sized potatoes in the planting of the 29th June was at least double that of 10th June, while the other was between these. The proportion of extra large potatoes in the first June planting was also at least double that of the last planting. A diseased potato was only got now and again, and it was so little that it was difficult to say whether there were more in one planting than another, as all might be considered, practically speaking, free of disease. Only one variety was used in 1889—viz., Early White Don.

In some districts of the east coast flax has been grown as an early summer crop, followed by early turnips as an autumn crop, and the results are said to have been highly satisfactory, and to warrant further experiments in the matter.

With winter tares and rye as an autumn and winter crop, flax has also been tried as a midsummer one, but with what success I cannot definitely say. After winter tares and rye, turnips can successfully be grown, and this I would personally recommend as being a more suitable farm crop than flax.

In the growth of winter tares there are two difficulties to contend with—viz., our moist and frosty winters, and the difficulty of consuming any large breadth of the crop at the time of the year when it is most desirable such should be done. Winter tares can stand almost any degree of frost if the atmosphere be dry, but frost and moisture alternately are very prejudicial to the crop.

The silo appears to be the most rapid and satisfactory way of preserving what of the crop cannot be eaten green. Where cows are tied in the house, a considerable area of it may be carted to them, or they may be led to it, as is done in Denmark, Sweden, and Germany. There the cows are led out to a field such as we would consider ready to begin to cut, and are tethered in a row across, say, one end of it at about 25 to 30 feet from each other. The ropes by which they are held are of course only about half that length, so that each cow cannot become entangled in its neighbour's rope. Each rope has an iron pin about 12 or 15 inches long and 1 inch in diameter fixed to its outer end, which is driven into the ground with a mallet, and which is quite sufficient to hold almost any animal to its position under ordinary circumstances. These pins are moved forward a little bit two or three times a-day, according to the luxuriance of the crop, length of the rope, and size of the animal. Under this system the cows are sometimes milked in the fields, in others they are led home to be milked; but under any circumstances, water has generally to be carted to each animal. In this way a crop from 3 feet to 5 feet long may be eaten clean off a field from one end to the other, and as the eating progresses the land may be ploughed and the following crop sown or planted close up to the stock consuming it. Whether or not such a system would give better pecuniary results in our climate than cutting and carting the crop to the animals in the house, I am not prepared to say; but I do not expect there would be very much difference, as in those countries even where tethering is practised a large breadth is also cut and carted to another batch of animals tied up at the farm.

III. A second crop of Italian rye-grass to be used for making silage, or, in very favourable circumstances, turning into hay.

This species of cropping is one which I think might with advantage be introduced on many more farms than it has ever yet been. Italian rye-grass is not very fastidious as to land or climate, provided plenty of manure is applied, and that of the proper kind. The good points of this grass are certainly only known to a small portion of the farmers of Scotland, otherwise it would be more extensively grown than it is. It surpasses all other grasses in the number of seed-stalks it throws up in the aftermath, and on this account no grass equals it for producing a second crop. Second crops of grass can only now and again be successfully made into hay, and the frequent losses thereby often met with in the attempt to make such into hay have no doubt had a good deal to do with the unfavourable opinion many farmers hold of it as a hay plant. Since the introduction of the silo, second crops of Italian rye-grass can now be saved with a certainty which the ordinary hay crop never possessed, so that the obstacles which previously existed against the growth of a second crop of Italian no longer exist. No grass more quickly responds to nitrogenous manuring than does Italian; and seeing of recent years we have had nitrate of soda and sulphate of ammonia at very reasonable rates, few if any crops can be grown cheaper or quicker than a second crop of Italian.

If the first crop for hay be cut between the time the plant has attained full bloom and the first period of the formation of its seeds, it will throw up its seed-stalks more freely than if allowed to stand longer before being cut. If the land be in moderate condition, and well seeded, from 1 cwt. to 1½ cwt. of nitrate of soda per acre, applied as soon as the first crop has been saved, will seldom fail to give a crop equal to the average hay crop of the country. Of recent years this has been attained at an expense for manure of from 10s. to 15s., while the labour of saving it is not great, and the rent and taxes are no more than if it had not been grown at all. For several years I have grown as much second-cut Italian as, when made into silage, has supplied succulent food from the middle of December to the middle of May to a herd of sixty Ayrshire cows in full milk, and with the very best results. The cows have been as healthy, if not more so than ever they were, and as much milk of as good a quality has been produced as the same number of cows were ever in the habit of yielding; yet this has been done without the growth of a single turnip or mangel for their use, the land formerly occupied by these crops being now available for something else. By this means, therefore, a large amount of extra food has been produced without adding to the acreage of the farm, and at no very excessive cost for either manure or labour, while the saving of it is, practically speaking, free of risk.

IV. Vetches (spring-sown) to be followed by Italian rye-grass.

In almost any season, and in most districts of Scotland, spring-sown vetches are ready to cut from the latter end of June forward, and about the middle of July they are at their best. According to the class of farm, they may be used as a soiling crop by being carted fresh to the byres or feeding-boxes, they may be cut and made into silage or hay, or in rotation fed off with sheep, up to the middle of August. It matters little which way the crop is consumed or preserved, but each section of the land, as soon as cleared, should be ploughed and thoroughly cleaned. According to the state of the land or previous manuring of the crop, a light dressing of farmyard manure may or may not be applied to the surface of the cultivated and cleaned land. If manure is applied, it should be broken very fine and ploughed in not over 3 inches deep. If the tilth is moderately fine, Italian rye-grass may at once be sown on the ploughed and unharrowed surface, and then well harrowed with any pair of ordinary harrows, the heaviest roller on the place being passed over it afterwards. Rye-grass so treated comes away very quickly, and the dung being buried very shallow, the roots of the plants soon get hold of it, and the crop is forced on at a most amazing rate. For standing the winter the seeds of Italian are all the better of being buried at least 1 inch deep, and they will not go far wrong although they be 1½ inch deep. It is a very strong germinating seed, and it quite easily forces itself through 1 inch or 1½ inch of any ordinary friable soil. When so covered it rarely fails to braird well, even in a dry time; and when alternate frosts and thaws set in, it is rarely heaved out of root by them. Such a crop comes on very quickly in spring, and if judiciously top-dressed, it may in favourable localities be ready to cut from the beginning of May forward. It also comes in very handy in April for feeding ewes with lamb, or, if not required for any class of stock, can be utilised as an ordinary hay crop; a second cut being taken in the autumn and made into hay or silage, as the circumstances of the farm require. Vetches and Italian rye-grass are two plants of exactly opposite natures—the first store up nitrogen in the soil in a state readily available for use by the second, which is a gross feeder of nitrogenous matters.

In districts where market gardening can be carried on, two crops in one season, or at least three crops in two seasons, are the regular rule. As such systems are, however, only applicable to a very limited area of Scotland, the various methods pursued need not be detailed here. It may, however, not be out of place to mention what are the principal aids which the market gardener calls to his assistance, in order to attain such an end. These are principally three—extra manuring, growing the crop in a seed-bed previous to planting out for the general crop, and intercropping. In ordinary farm practice it seems impossible to grow a grain crop in any less time than we have been in the habit of doing it. Farmers need not of necessity all confine themselves to grain-growing, or the production of beef, cheese, butter, or milk, but wherever the circumstances are favourable, adopt such systems of starting crops as is shown in the boxing of potatoes, or doubling the rate of growth as is shown by manuring the aftermath of a crop of Italian. As new plants and new varieties of old plants become introduced, the shortening of the time a crop occupies the ground may become more easy than it is at present, and the farming of the future may partake much more than it presently does of the nature of market gardening, both in the matter of manuring and rapidity of growth. We now have none of the extreme late seasons our fathers and grandfathers used to tell us of, not that I think the seasons are any better or any worse than they used to be, but because much earlier varieties of grain and other crops are now used, while the land being now mostly all well tile-drained, is easier cultivated and is better manured. The land being drier, the seed can be sown earlier, and being sown earlier, the crop, as a rule, matures sooner; while the general dryness of the land during the whole growing season also hastens its maturity, and when harvest arrives, the use of the reaping-machine and binder enables the fields to be cleared much quicker than formerly. Considerable time has already been saved in the growing period of ordinary farm crops, and in the future this may be further improved on by means something similar to those already described, one or other of which may be taken advantage of by many farmers.

TREES AND SHRUBS BEST ADAPTED FOR PLANTING AS SHELTER IN THE ISLANDS OF SCOTLAND.

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THAT the islands of Scotland were at one time plentifully supplied with trees there is ample testimony in the remains of such as have from time to time been found in many of the lochs, peat-bogs, and at low-water mark along the coast; while in not a few instances, the remains of even later forests may still be detected in the large, old trees, principally of indigenous growth, that are to be seen on some of these islands.

With the destruction of these forests, principally at the hands of marauders in the middle ages, as also by inhabitants of the isles at the same and a later period, the few remaining trees were ill fitted for withstanding the effects of the storm, so that these gradually gave way and left the islands in the state they are at present, or rather were, some half a century ago.

But not only has a barren, treeless appearance of the isles been the result of this ruthless destruction of the forests, but also a general deterioration of the soil, for it is only reasonable to suppose that the loss of vegetable mould, with which during their wooded epoch they were annually enriched, must have told severely on the general condition of the ground. This gradual falling off in the quality of the soil renders it a matter of no little difficulty to restore these islands to a state fitting for being successfully replanted. With skill in selecting suitable trees for the various classes of soil, aspect, and situation, and a proper system of planting, much may, however, be done to get up shelter, and so, to a very great extent at least, ameliorate the climatic extremes to which at present these islands are so unfortunately subjected.

In the selection of trees for planting on the islands around the mainland of Scotland, two important matters must be borne in mind: first, that they are such as are sufficiently hardy to withstand the severe storms and cold cutting winds to which they are, in most cases at least, exposed; and second, that they are such as can do battle in a satisfactory way with the salt-laden spray and ozone of the atmosphere.

Few persons other than those who have been actually engaged in the formation of belts or plantations on exposed and wind-swept seaside grounds have the remotest idea of the difficulties to be encountered in so doing.

To plant young trees around many of the isles, on the west coast of Scotland at least, but particularly where wide stretches of open seaboard are to be dealt with, without first erecting a shelter screen of some kind or other, is useless work, and only productive of the most unsatisfactory results. That there are not a few districts, however, where such a preliminary would be needless is well known, all that is required in certain instances being, first of all, to prepare the ground, and, second, to suit the plants to the soil, for that certain varieties of trees are much better adapted for particular situations than others is a fact that is well known. From experience, and that, too, gained at considerable cost, I have found out how useless it is to plant in a haphazard way, on the more exposed seaboards along the west coast; whereas, by careful manipulation, I have been successful in getting up shelter where before it was deemed an impossibility.

The chief consideration in seaside planting around the Scottish isles is unquestionably shelter, be it only of a temporary kind, for it may be noticed anywhere along our coast that wherever the direct force of the hurricane is broken, there trees and shrubs are growing best. Another evil—a great one too—with which the planter has to contend, is the injurious effect caused to trees, but more particularly evergreen shrubs, by the saline particles which are driven and deposited with such force on the leaves and branches as in many instances to give them the appearance of having been scorched or cut over when in full vigour by an untimely frost.

Wind-shaking, although a minor evil, must also be carefully guarded against, so that at the outset it is well to have all trees, unless such as are of a dwarf size, securely staked and tied so as to obviate the dire results occasioned to the roots of newly planted trees when the stems are allowed to rock to and fro with the wind.

As a considerable portion of the margins of the Scotch islands is composed of sand, and as shelter-belts should, where at all practicable, be formed near to the coast, the planting of these sandy wastes will first be considered. My object in this paper is, however, not so much to point out the methods adopted for obtaining shelter, as to bring under notice such trees and shrubs as are well suited for the purpose under consideration, and also to show that the monotonous repetition of some, half-a-dozen kinds, which for centuries have been known as suitable, is by no means necessary. Before commencing planting operations on the sandy coasts above referred to, the preliminary step is to erect a barrier of some kind, which will intercept the violence of the wind and act as a screen or shelter to the young plants. For this purpose various kinds of erections are equally suitable, but that usually adopted, especially where loose sand alone is present, is a strong paling-fence thatched with brushwood. The posts should be at least 6 feet above ground and 15 feet apart, the paling-rails, two in number, being securely nailed to these at 2 feet and 5 feet from the ground. Against this is placed spruce fir or gorse trimmings, these being 6 feet long if possible, in an upright manner, and firmly tied to the cross bars by means of strong tarred rope. This may well be described as a dead hedge, but it is, nevertheless, quite as valuable for the purpose required as a perfectly developed living fence. By means of this a great advantage is gained, and a favourable start for the newly planted trees is ensured.

Then, compared with a stone wall, or in fact a wall of any kind, this screen-fence is greatly superior, the wind being broken up in passing through it, and what is of as much value also, relieved of its saline particles, at least to a very considerable extent.

Where the shore is almost destitute of sand, and where certain kinds of vegetation subsist, I find it to be a capital plan to substitute for the dead fence just described, that composed of turf and earth. The raised mound should not be less than 5 feet in height, and of sufficient width atop to allow of the planting of a double or treble line of such plants as have been found most suitable for the wind-swept maritime situation in which they are to be used. For this purpose few plants equal, and certainly none surpass, the *Sea Buckthorn* (*Hippophaë rhamnoides*), *Tamarisk* (*Tamarix gallica*), the common *Hazel*, *Elder*, *White Thorn*, and at least three species of *Willow*—*Salix caprea*, *S. helix*, and *S. alba.* Immediately behind this screen, pits of not less than 2 feet in diameter, and about 18 inches in depth, may be formed, and all the better if so for a length of time previous to being planted. The bottom and sides of each pit should be well loosened with a pick; and if the soil is found of inferior quality, it will be well, more especially where such can readily be obtained, to add a spadeful or two from some adjoining field.

Planting operations should not be begun before March or April, an early start at growth being much in favour of young trees that have but recently been transferred to the sea-coast.

The plants to be used should not exceed 12 inches in height, but should be of strong growth in proportion to their size, and supplied with an abundance of fibrous roots, lanky, ill-grown, and coddled plants having but a poor chance of succeeding under such adverse circumstances. In planting keep the strongest roots seaward, and do not place the trees at a greater depth in the soil than they stood whilst in the nursery border, this latter being an oft-committed mistake that is productive of anything but favourable results.

Immediately behind this raised mound of turf and soil, or the dead fence of branches above described, the best trees for withstanding the first brunt of the sea-breeze are the *Sycamore*, *Elm*, and *Willow* amongst hardwoods, and the *Austrian* and *Cluster Pines* (*Pinus austriaca*, and *P. pinaster* and its smaller growing variety *maritima*), to which may be added *P. laricio*, *P. sylvestris*, and *P. pumilio* amongst conifers. These are all well-tried subjects, and may be relied upon as being peculiarly well suited for doing battle with hard-blowing and long-continued storms on the sea-coast. Regarding the merits of the Cluster pine for seaside planting, it would be almost superfluous for me to speak; while the elm and sycamore send out their strong branches into the very teeth of the blast, and are known as being peculiarly well suited for such situations.

The following list of trees and shrubs are such as I have, from long personal experience, found to be well suited for planting on cold and wind-swept shores, such as the various islands around the coast of Scotland. They are likewise arranged according to their value for so doing:—

HARDWOODS.

The Sycamore (*Acer pseudo-platanus*) is, without doubt, the most valuable tree of timber size that I have come across for planting in exposed seaside situations. It succeeds well even at high-water mark, the stout twiggy branches being thrown out into the very face of the blast. Even during winter and in a leafless state, the amount of shelter afforded by this tree is quite surprising.

With the greatest success I have planted the sycamore on many parts of the western coast, and in situations, too, where the wind blew hard and long, frequently for a week at a time, and where the branches were almost lashed by the sea-spray. Taking everything into consideration, its great hardihood, and suitability to various soils and situations, I consider the sycamore the most valuable of any tree that I have yet tried for seaside planting.

The Elder (*Sambucus nigra*) is, amongst small-growing trees, the best for planting in exposed seaside districts. Its powers of endurance are greater even than those of the sycamore, although the amount of shelter it affords is by no means so great. Where its branches are constantly exposed to the saline-laden breeze, and its roots amongst almost pure sand, it grows and thrives in a manner that is perfectly surprising. With the greatest advantage have I used the elder as a windbreak on some of the most exposed and desolate coasts of the British Isles. Even where grown as a single specimen, it seems to heed not the angry blast nor saline particles with which it is almost constantly pelted—a fact that may be verified in not one but several stations along the coast. At Farnley, in Lancashire, where the wind is frequently blowing with hurricane force, and where wrecks are, unfortunately, too common, stands a solitary elder-tree, the large proportions of which render it a conspicuous object on the dry, dreary plains of sand, and where it is visible for fully a mile in almost every direction. Then, what tree is of readier culture than the elder, succeeds better in poor sandy soil, or spreads about to an equal extent?

The Norway Maple (*Acer platanoides*) stands the first brunt of the sea-breeze in a most commendable way; indeed it may be recommended as one of the most hardy and valuable trees for the purpose under consideration that could be named. On the western coast of England, and in a very exposed and windswept district, I have used it with the greatest success in the formation of plantations, it growing rapidly, and soon forming an excellent shelter to other less hardy kinds of trees. In its native country, the shores of the Baltic, and west coast of Norway, it attains to large dimensions, while in this country its handsome appearance and hardy nature have already placed it high in the estimation of planters. It is by no means particular as to the soil in which it is planted, but succeeds all the better if this is fairly rich.

The Winged Elm (*Ulmus alata*).—From a long experience of this, at present, little known tree, I have every confidence in recommending it as one of the most valuable trees for planting in cold, wind-tortured, and maritime districts that have yet found their way into this country. I have used it largely in the formation of shelter-belts, at high altitudes along the English coast, and have little hesitation in recommending it as a valuable adjunct to the trees that have already been recommended. Where many of our hardiest trees are bent and shrinking from the blast, this elm stands nobly out, and seems as if to defy both wind and storm. As usually seen in this country, the winged elm is a tree of small stature, rarely exceeding 20 feet in height, but it is bushy in proportion to its height, and of a neat habit of growth.

The corky, winged branches impart to this American elm a most peculiar and distinct appearance, and readily distinguish it from any other member of the family to which it belongs. I have not found it to be in the least particular as to the soil in which it is planted.

The Huntingdon Willow (*Salix alba*) and the *Bedford Willow* (*S. Russelliana*), but particularly the former, are excellent trees for windy shores. In many places along the coast the Huntingdon willow may be seen in a most flourishing and happy condition, and that, too, where the surroundings are the reverse of favourable. It is a tree of quick growth, and will succeed well in any class of soil, if it be not too damp.

Where fully exposed to the fierce blast from the seaside I have planted the Huntingdon and Bedford willows with the best possible results, hardly a failure occurring in each score of acres planted.

In one instance the trees were planted on a promontory overhanging the sea, and in such a situation that they were almost constantly subjected to rough-blowing winds coming in from the Irish Sea, and yet they have grown with the greatest freedom, and to-day look as healthy and happy as if planted in some sheltered inland situation. These willows cannot be too strongly commended for adding shelter to the islands of Scotland.

The Beam Tree (*Pyrus aria*) is another excellent, small-growing tree for planting in sites where, from cold saline blasts, few others could eke out even a miserable existence. On the limestone cliffs of the Great Ormes Head, this handsome and hardy tree grows in a most surprising way; indeed, with the exception of one or two species of willow, I question very much whether any other tree could exist under the trying circumstances. The wind blowing in from the Channel, and hitting hard with its accompanying saline spray, gives very few plants a chance of succeeding for even a short period of time.

The hard, leathery leaves seem as if specially constructed for bearing storms, and being plentifully produced, render a great amount of shelter to other trees.

The Goat Willow (*Salix caprea*) for planting in almost pure sand on the sea-coast is a most valuable small-growing tree, and then it is so hardy that, without the least risk of harm, it may be planted at great altitudes and in very exposed situations. It is of very free growth, luxuriating as it does where the soil is of very ordinary quality. In several of the maritime plantations that I have formed, this willow was used with remarkable success in the outer line or screen. There it may not attain to the size that it does in more favoured localities, but it nevertheless increases in width, and soon forms a shelter which, although dwarf, is of the greatest value in maritime woods.

The Aspen (*Populus tremula*) is an excellent shore tree, one that can withstand a great amount of rough usage, and as hardy and fast-growing a subject as could well be desired. In the formation of several exposed seaside woods on the west coast of England I planted the aspen largely, and, I may add, the results have been most satisfactory.

It soon becomes established, even where the soil is of very inferior quality, grows rapidly, and forms an excellent shelter to other less hardy kinds of trees.

P. canadensis, *P. alba*, and *P. nigra* are likewise well worthy of extended culture, for they succeed well under very adverse conditions both of climate and soil. They all stand the breeze from the sea well, are perfectly hardy, and afford a considerable amount of shelter.

The Mountain-Ash (*Pyrus aucuparia*).—Although valueless, or nearly so, for the quality of timber it produces, yet as a hardy free-growing tree the mountain-ash or rowan-tree merits attention from planters of exposed seaside land. With the greatest of freedom it grows, and produces a rich abundance of its showy fruit, when planted in desolate tracts of country and where little or no shelter is to be obtained. All along the coast of Great Britain this pretty tree may be found growing luxuriantly, and in such situations affording a great amount of shelter to other less hardy kinds of trees and shrubs. It may be planted, without fear of harm, down even to high-water mark, and where the soil is of the poorest description, and is thus one of the most useful of trees for planting as shelter along the roughest and most wind-tortured parts of the coast.

At high altitudes, too, it succeeds in a most remarkable way, and does not seem in the least distorted although fully exposed to the severest of storms.

The Hoary Alder (*Alnus incana*), and the common form (*A. glutinosa*), can hardly be excelled for planting in wet portions of cold, wind-swept ground and in the vicinity of the sea. Both trees grow with great freedom, and are perfectly hardy, standing the first brunt of the saline blasts in a most commendable and praiseworthy manner.

I have found it to be a good plan where shelter is wanted on bare coast tracts, if the quality of soil be at all suitable, to plant the alders pretty closely, and when they attain to 15 feet or 20 feet in height, to cut every alternate one over at ground level. By so doing a number of stout shoots are sent out early in the following spring, which, as they grow with great rapidity, soon fill up the blanks occasioned by cutting over the young trees. After these have had three years' growth, the remaining half of the original crop should be cut over, and when all have started from the stools a first-class shelter is obtained.

I would strongly urge those in charge of plantations on exposed seaside ground to plant the two alders above-named in quantity, and by treating them as just suggested, a shelter-screen will be got up which, for efficiency, has certainly very few equals. Of course damp portions of the ground should be selected on which to plant the alder.

The English Maple (*Acer campestre*) can well hold its own as a tree for planting on exposed seaside grounds. It is one of the hardiest trees with which I am acquainted, growing on the exposed hillside, and at considerable elevation, in a way that seems to attract the attention of every one.

Hedges or fringe-fences of the native maple have succeeded amazingly in several maritime woods in which it was planted, and in places, too, where the wind blew loud and long. In such places it may not attain to its usual dimensions, but that is hardly what is wanted on the islands of Scotland, for by growing at all in such forlorn, cold, and dreary districts is what is principally looked for in trees and shrubs.

The English maple is, too, a most distinct and handsome tree, for the finely cut leaves and general well-rounded contour of the head are peculiarly pleasing. No special care is required in the cultivation of this tree, and it succeeds well in dry poor soil and where little or no shelter is afforded.

The Scotch Elm (*Ulmus montana*) comes next in the list of such trees as I would recommend for the purpose under consideration. It affords plenty of shelter, growing as it does freely from the root-stock, in the way of sending up suckers, and is so hardy and proof against damage from storms, that it may be safely planted on high-lying and wind-swept districts. On the west coast of Scotland it is no uncommon thing to see the mountain-elm growing in such bare open spots, that one almost wonders how it can survive such sweeping storms and adverse conditions.

As a tree for affording shelter, this elm is certainly one of the best, while, being of free growth and easy culture, its requirements are few indeed.

The Birch (*Betula alba*).—For planting on exposed sites within the influence of the sea, the common birch is well worthy of a foremost place amongst such trees as have been found suitable. Wherever the least shelter from the saline blast is obtained, there the birch will thrive well, and prove itself a most valuable addition to kinds that are suitable for such situations. Dry rocky wastes come not amiss to this graceful tree, for there it grows with great rapidity, and reproduces itself in amazing quantities from seed.

The Ash (*Fraxinus excelsior*) is another tree that repeated experiments have proved to be a most valuable subject for withstanding ocean blasts. In its younger stages it grows with freedom, and soon produces a great bulk of valuable timber. When cut over by the ground it sends out a number of stout shoots, and these are of great value for the warmth and shelter they afford to other less hardy kinds of trees and shrubs.

The Evergreen Oak (*Quercus ilex*) has proved itself to be peculiarly fitted for planting as shelter in exposed and maritime districts.

In the formation of seaside plantations, but particularly where, from the frequency and force of storms, few trees can succeed, I have planted the evergreen oak with the best success. In inland woods, too, at high altitudes, where the storms are frequently of a most severe character, the evergreen oak, when once thoroughly established, affords such amount of shelter as to place it first in the rank of trees that are suitable for such a purpose. It is of a hardy nature, the stiff thickly produced leaves making it almost an impenetrable wind-screen.

True, it transplants badly, but this may readily enough be done away with, by attending to frequent removals whilst in its first stages of growth.

For hardihood, beauty of appearance, and the shelter it affords, it has few equals.

The Turkey Oak (*Quercus cerris*).—With just a small amount of shelter the Turkey oak will be found to be a most valuable tree for planting in wind-swept districts within the influence of the sea. It thrives well in very poor soils, and, when in full leaf, is capable of affording a great amount of shelter, and acting as a nurse to more tender plants.

For the seaside it is a valuable tree, and may be seen growing stout and strong where constantly subjected to the saline blast. Then, too, it succeeds well at high altitudes, if just a little amount of shelter is afforded. It is to be highly recommended for the purpose under consideration.

The deciduous trees just treated of have no equals, among such as have yet been introduced, for withstanding cold seaside winds, a trial of many other varieties only resulting in proving their unfitness for planting in such situations. Two or three others, such as the English oak, hornbeam, beech, and English elm, might be added to the list, but they can only be recommended for planting where, at least, partial shelter is afforded.

CONIFERÆ.

Foremost amongst these I must, from long personal experience, and a fair trial of several kinds under exactly similar conditions in every way, place the *Austrian Pine* (*Pinus austriaca*). It grows with unusual freedom, and affords a greater amount of shelter than any other tree with which I am at present acquainted. That it will succeed equally well with *P. pinaster*, when subjected to the sea-breeze, I am now fully convinced, while the amount of shelter it affords, and rapidity of growth, place it far ahead of that species for the purpose we are now considering. It may not succeed so well as the Pinaster when planted in almost pure sand on the sea-coast, and this is the only point that can be adduced in favour of the latter species over *P. austriaca.*

In the forming of many large woods along the coast of northern England, I used the Austrian pine in preference to any other, and happily too, for it has succeeded in a surprising manner, trees of ten years' growth being fully 13 feet in height, and nearly as much in diameter of branch-spread.

With such a screen as that afforded by the hardy Austrian, many half-tender trees may be planted farther inland; and this is the method of procedure that I have found to be most successful in getting up shelter along bare and fully exposed parts of the shores of western England and Scotland. Where the soil is rocky, or with a calcareous infection, the Austrian thrives well, and soon attains to a considerable size. Another good point in favour of the Austrian is, that it transplants with perfect safety when of large size—that is, of course, if attention has been given to its nursery management in the way of frequent removals. For planting as shelter on the islands of Scotland, where the soil is anything but pure sand, the Austrian has certainly few equals. Overcrowding of the trees must be carefully guarded against—a great point in their management, where shelter is the main object, being to preserve the lower branches in a healthy state—a matter that is readily enough achieved by giving plenty of room for their perfect development.

The Cluster Pine (*P. pinaster*), and its smaller-growing variety *maritima*, have a world-wide reputation as to their suitability for planting on exposed seaside tracts of ground. That they are of great value for planting on sandy wastes is a fact that cannot be gainsaid; indeed, few other trees could succeed, or even eke out a miserable existence, in pure sand, and where the roots come in contact with the salt water.

A great drawback to this pine is that, owing principally to its long tap-root and want of smaller fibrous roots, it transplants with difficulty; but this, as in various other species of pine, may be greatly obviated by careful nursery management. Another drawback to the extensive use of the Cluster pine for purely shelter purposes is that, do as one will, the lower branches gradually but surely die off. This cannot be averted even by the best and most skilful management, for even trees that are growing as standard specimens, and at a considerable distance from any others, are similarly afflicted with the loss of the lower branches.

In my own opinion, the typical tree is hardly equal to the variety *maritima* either for shelter or for withstanding the sea-breeze. The variety, too, is, if anything, the most valuable for shelter-giving, it having a much greater inclination to retain the lower branches intact.

Where the soil to be planted is composed largely of sand, by all means use the Cluster pine; but in any other case it will be found wise policy to give the Austrian a fair chance.

The *Corsican Pine* (*P. laricio*) quite equals the Austrian in its powers of withstanding long-continued and cold winds. That it does not succeed, however, so well on the sea-coast, is a fact of which, from repeated experiments, I am fully aware. For high-lying and wind-exposed places it is just the tree, and I have every confidence in recommending for extensive planting this valuable species of pine. On some of the high-lying hills along the western coast of England, I planted about ten years ago a great number of the Corsican pine. These, although fully exposed to sea-storms, have given every satisfaction—being only equalled by the Austrian in their powers of withstanding cold cutting winds at high elevations. The Corsican pine, too, is a valuable timber-producer—a fact that is well worthy of consideration in extensive planting.

In the *Giant Arborvitæ* (*Thuja gigantea*) we have another excellent addition to the list of trees that have been found suitable for planting on exposed and maritime situations. It grows with great rapidity, and I have never found even a solitary example of this tree having been uprooted or injured during the most severe storms. On the sea-coast of Carnarvonshire I have used the Giant Arborvitæ largely in the formation of woods and plantations; while at 600 feet altitude on the same estate it was largely used—not only on account of its hardy nature, but for the great and much-needed shelter that it affords to other less hardy kinds of trees and shrubs. In this particular instance the trees have done remarkably well; but it is but fair to add that the soil in which they were planted was of fairly good quality, although the situation could not be said to be at all favourable. I have every reason to believe—not only from my own experiments and observations, but likewise from the thriving of the trees in various parts of the country—that the Giant Arborvitæ will, when its good qualities become better known, be very largely used in the formation of plantations on exposed grounds. It transplants with the greatest freedom even when of large size, and is readily enough propagated—two points that will tell much in its favour for extensive planting.

Pinus montana may also be recommended for afforesting and shelter-giving on the Scottish islands. It is a tree of undoubted hardihood, withstanding cold and cutting winds at great altitudes. Being of dwarf growth, but dense and twiggy in proportion to its height, the mountain-pine is to be recommended for planting wherever a screen or shelter is desirable. From considerable experience both with this plant and with the so-called *P. pumilio*, I have every reason to believe that they are identical.

The Scotch Pine (*P. sylvestris*), though by no means equal to the above for planting as shelter on the islands of Scotland, must on no account be omitted from our list, for it is a hardy, fast-growing species, and one that can do battle with very severe and long-lasting storms. It should not be planted where it will meet the first brunt of the storm, but given a little shelter such as that afforded by the above-named kinds.

The varieties of pine just named may all be relied upon as peculiarly well fitted for the purpose under consideration. *The larger-fruited Cypress* (*Cupressus macrocarpa*), and *Pinus insignis*, might have been added to the list, but neither, although peculiarly well suited for planting on the sea-coast, have been found able to withstand the cold of the extreme northern Scottish islands.

Pinus insignis grows with unabated vigour on the wind-swept coast of England (at Bodorgan, in Anglesey), and stands the breeze and cold cutting winds in a most surprising and praiseworthy manner.

For inland situations neither of these trees is to be recommended; while for the sea-coast, be it ever so wild and exposed, they may be planted in any part of England or southern Scotland, with every chance of their succeeding well. Both are trees of great beauty, and also afford a vast amount of shelter wherever they are used.

The Atlantic Cedar (*Cedrus atlantica*), and the *Swiss Stone Pine* (*P. cembra*), have both succeeded well on the coast of the Irish Sea (on Penrhyn estate, North Wales).

They were not planted so as to receive the full force of the wind coming in from the sea, but at about 50 yards therefrom, and where partially sheltered by a fringe composed principally of the trees recommended in this paper. The cedar, in particular, is of great value for the seaside, and will yet form an important adjunct to the rather short list of suitable varieties for such a place.

SHRUBS.

The Sea Buckthorn (*Hippophaë rhamnoides*) is unquestionably the best all-round shrub for planting as a shelter in wind-swept districts with which we are acquainted. To see it in several districts of Scotland, growing almost amongst pure sand, and where constantly exposed to fierce blasts, shows how valuable a shrub it is for exposed maritime situations.

For affording shelter it is one of the best shrubs that I know of, the remarkably twiggy branches sifting and dividing up the wind in a remarkable manner. Then, too, it is a very ornamental shrub, the silvery leaves and wealth of golden fruit placing it in the first rank for ornamental purposes. On the coast of Wales, and where fully exposed to the rough blowing winds coming in from the Irish Sea, I have used this shrub in quantity for shelter-giving purposes. It was planted amongst shingly gravel without any preparation of the ground, and though only ten years have elapsed since that time, yet many of the plants are as much as 8 feet in height, and fully half as much in diameter of branch-spread. With the greatest confidence can I recommend this handsome and hardy shrub for affording shelter wherever it is planted along the coast of Great Britain.

Tamarix gallica and *T. germanica* are two excellent seaside shrubs, and such as are well suited for planting in exposed places.

They grow with great freedom, transplant well, and are readily propagated.

Even in pure sand they seem quite at home, growing freely, and producing a rich abundance of their showy flowers. In very exposed parts of the coast, and where fully open to direct sea-blasts, we have frequently seen the tamarisk fully a dozen feet in height, with a lateral spread of nearly as much.

Though little known, *T. germanica* is a most valuable seaside shrub, of about 6 feet in height, with small leaves, and spikes of conspicuous red flowers.

The Box Thorn (*Lycium europæum*) may be introduced without fear of harm to the seaside woods, for it is not only perfectly hardy in such situations, but it bears constant exposure to wind as well as any shrub I know of.

From personal experience I can confidently recommend the box thorn for extensive planting along the coast and on the islands of Scotland.

It is of low, straggling growth, and soon increases to a great extent.

Hedges of this plant have been formed in many maritime parts of England and Wales, the only support being a few stakes driven in here and there along the line of fence. It will grow in pure sand, and where lashed by the waves.

The Snowberry (*Symphoricarpus racemosus*) comes next on the list of shrubs that have been found suitable for the purpose under consideration. It is a plant of extraordinary hardihood, one that increases rapidly from the root-stock, and that affords a fair amount of shelter. With the greatest success have we used the snowberry for filling up blanks that have been occasioned by long-continued sea-storms.

Griselenia littoralis has stood a severe test as to its adaptability for withstanding cold winds blowing in from the sea.

It is a plant that seems to be peculiarly well suited for exposed seaside planting, the close habit of growth, thick leathery leaves, and immunity from damage by cold winds, being its particular points of merit. It is at present not well known; but now that its undoubted value for the smoky town and exposed seaside have been fully tested, there can be little doubt that it will occupy a prominent place amongst hardy shrubs.

The Dogwood (*Cornus sanguinea*) is a shrub that is well known for its value in imparting shelter to exposed ground on the sea-coast. Being very hardy, of free growth, and not liable to injury from long-continued storms, it is just the shrub for planting on the islands around the coast of Scotland.

Ribes sanguineum will grow and flower freely where its foliage is almost lashed by the waves. It will not, however, thrive if planted in pure sand; but where a small quantity of loam or vegetable mould is present, it starts away freely, and soon forms a bush of respectable dimensions. Being perfectly hardy and easily propagated by cuttings, it is just the plant for introducing in quantity to maritime woods.

The Tree Purslane (*Atriplex halimus*) is also a really valuable shrub that is totally indifferent to the salt spray, and which, from its dwarf, evergreen nature and silvery scaly leaves, is also more or less ornamental. It does not seem to mind either wind blowing direct from the sea, or whether the soil in which it is planted is of even fairly good quality. Of free growth, perfect hardihood, and being adapted for the sea-coast, it might, with advantage, be introduced to the islands of Scotland.

The Laurustinus (*Viburnum tinus*).—Where the situation is not too exposed, the Laurustinus is a most valuable and ornamental maritime shrub. Throughout England generally, on the coast, it grows without a shadow of harm, and puts on its best form even in the very teeth of the blast. As an ornamental, free-flowering shrub, and one that is easy of reproduction, and, at the same time, not at all fastidious about the class of soil in which it is planted, the Laurustinus is of great value. Screen-hedges of this shrub, if spared from direct influence of the storm, succeed well, and as it bears trimming well, may be pruned to any desired shape.

Lilacs of various species are well adapted for planting on exposed maritime situations. They do not seem to suffer, at least to any appreciable extent, from the saline blasts; and as they are all highly ornamental subjects, should be used largely in the formation of plantations along the coast.

The common and Persian Lilacs (*Syringa vulgaris* and *S. Persica*) are most to be recommended.

The Spanish Broom (*Spartium junceum*) has been used with the greatest of success all along the coast, it being perfectly hardy, and an excellent subject for cold, draughty positions. It much resembles our common broom, but is of more compact growth, and consequently better suited for affording shelter. That it is not particular about the soil in which it is planted, a glance at some of the woods along the shores of the Mediterranean Sea but too plainly points out. Where the sand has the least admixture of soil, this pretty, bright-flowering shrub succeeds well, and does battle in a wonderful way with the saline-laden spray. It forms a good live fence, the closely set, stout, and twiggy branchlets bearing pruning well, and soon forming, under careful management, an almost impenetrable mass of shoots.

The Tree Groundsel (*Baccharis halimifolia*) is not only a shrub of great beauty, but one that is perfectly hardy, and well adapted for the seaside. It will thrive almost in pure sand, but is all the better of a poor gravelly loam, and seems to delight in the ozone of the seaside atmosphere. It is an excellent shelter plant, and one that is well worthy of a far greater share of attention at the hands of planters than it has hitherto received.

Both the *Portugal Laurel* (*Prunus lusitanica*) and *Sweet Bay* (*Laurus nobilis*) are valuable evergreen shrubs for seaside planting. They afford, from their large size and compact habit, a great amount of shelter to other less hardy kinds of shrubs and small plants, and for this purpose they are largely used along the English and Welsh coasts.

The saline blasts coming in from the sea do not seem to tell the least unfavourably on either of these shrubs, while they will bear rough winds almost with impunity. Both grow with the greatest freedom after becoming thoroughly established, and thrive well in soil of ordinary quality.

The Common Holly (*Ilex aquifolium*) and its golden form are excellent subjects for planting in exposed and cold districts within the influence of the sea. They afford a great amount of shelter after becoming thoroughly established, and thrive well in soil of average quality. They will not do for planting in pure sand on the sea-coast, but will succeed almost where lashed by the spray, if the soil in which they are growing is of fair quality.

Being excellent maritime plants, they should enter largely into the composition of woods and belts that are intended for shelter along the sea-coast. The golden-leaved form is equally valuable with the normal plant for exposed seaside planting.

In the *Laburnum* (*Cytisus laburnum*) and the *Scotch Laburnum* (*L. alpinum*) we have two fairly hardy small-growing trees that thrive well within the influence of the sea.

They are both highly ornamental, and may be used with advantage wherever the direct force of the blast is broken up.

The Common Gorse (*Ulex europæa*) and the *Broom* (*Cytisus scoparius*) should on no account be omitted from our list of shrubs that are valuable for maritime wastes, where the wind exerts its full power. I have used the gorse with great success in getting up a shelter-screen along an exposed sandy waste on the west coast of England, and I must say that I was not a little surprised how well it succeeded on the higher knolls of the sandy ground. Finding how well it did in this particular instance, I had the ground, where other trees and shrubs had died out, hoed over and slightly broken up, and afterwards sown with home-saved seeds of both the broom and gorse. The experiment turned out quite a success, the whole ground within a dozen yards of high-water mark being now completely covered with a healthy undergrowth. Not only so, but the shelter afforded allows of the growth of other less hardy kinds.

The above shrubs include all that I can, from my own experience, recommend for planting as shelter in the islands of Scotland. Where good shelter is afforded by the hardwoods and conifers named in this paper, a few others, that I have used largely for seaside planting on the coast of Carnarvonshire, and where fully exposed to the winds blowing in from the Irish Sea, might be recommended for trial. These include the *Strawberry Tree* (*Arbutus unedo*), an excellent shrub for semi-sheltered positions along the coast; *Euonymus japonicus;* several varieties of *Berberis Darwinii*, which flourish amazingly on the island of Anglesey; the *Oval-leaved Privet* (*Ligustrum ovalifolia*), *Daphne Mezereon*, and *D. laureola*, the *Butcher's Broom* (*Ruscus aculeatus*), *St John's Wort* (*Hypericum calycinum*), *Vincas major* and *minor*, and several kinds of *Thorns.*

The *Maram* or *Sea Matweed* (*Psamma arenaria*) is one of the most useful grasses with which I am acquainted for binding shifting sands on the sea-coast. Not only so, but by using it as a pioneer the amount of shelter it affords renders other more difficult subjects by no means hard to cultivate. It usually attains to from 2 feet to 2½ feet in height, much depending on the situation, whether partially sheltered or fully exposed. The root-stock creeps widely, some specimens that have been followed up in the sand being of the amazing length of 35 yards. It is, unfortunately, of no agricultural value, farm stock generally refusing it, even when pressed by hunger; the stiff, almost woody and innutritious stems generally rotting away from year to year on the ground where they grew. Amongst loose and drifting sand the running roots find what is most suitable for the welfare of the plant, and it is astonishing with what persistency they bind in an unusually short space of time these shifting hills of dust-dry sand. In planting, the best way, I have found, is to place the grass in parallel lines, 16 inches apart, and at a distance of 12 inches from plant to plant. Large masses of the matweed may be carted to the planting ground, and there divided into smaller pieces of, say, 6 inches diameter. A garden-line is stretched along the ground, a notch 10 inches deep taken out, the grass inserted therein and filled with sand, and afterwards firmly trodden. This simple process completes the planting, and usually no attention is required afterwards, unless it may be to replace some of the stocks which either by subdividing or a wrong system of planting have died out. It is perhaps a pity that the value of the matweed is not better known for binding shifting sands, for that it might be in scores of cases used with the greatest advantage is evident to any one who is acquainted with particular stretches of sea-land along the coast of Great Britain. A few years ago an interesting experiment was tried to fix the blowing sands on the sea-coast near Rhyl, in North Wales, by means of the above grass; and as the undertaking has turned out to be a complete success, I thought it might be useful to others were I to state how the work was performed. That the sea matweed is a most useful plant for first gaining a footing on sandy tracts of sea-coast, and thus allowing of following up with shelter-giving trees, is a fact that cannot be disputed.

The following list of trees and shrubs alphabetically arranged, from my own experience is recommended for planting as shelter in the islands of Scotland:—

TREES FOR SHELTER.

Acer campestre.
„ *creticum.*
„ *pseudo-platanus.*
Alnus glutinosa.
„ *incana.*
Betula alba.
Carpinus betulus.
Cedrus atlantica.
Cupressus Lambertiana.
Fagus sylvatica.
Fraxinus excelsior.
Pinus austriaca.
„ *laricio.*
„ *montana.*
„ *pinaster.*
Pinus pinaster maritima.
Populus canadensis.
„ *nigra.*
Pyrus aucuparia.
Quercus ilex.
„ *robur.*
Salix alba.
„ *caprea.*
„ *Forsteriana.*
„ *Russelliana.*
Thuja gigantea.
Ulmus alata.
„ *campestris.*
„ *montana.*

SHRUBS FOR SHELTER.

Atriplex halimus.
Aucuba japonica.
Cerasus lusitanica.
„ *padus.*
Cytisus laburnum.
„ *scoparius.*
Euonymus japonicus.
„ *europæus.*
Fabiana imbricata.
Griselina littoralis.
Hippophaë rhamnoides.
Ilex aquifolia.
„ *aquifolia aurea.*
Laurus nobilis.
Lycium europæum.
Rhamnus frangula.
Ribes sanguineum.
Rosa spinosissima.
Shepherdia argentea.
Spiræa adiantifolia.
Syringa persica.
„ *vulgaris.*
Symphoricarpus racemosus.
Tamarix gallica.
„ *germanica.*
Ulex europæa.
Viburnum tinus.

GRASSES.

Elymus arenarius.
Psamma arenaria.

FORAGE CROPS SUITABLE FOR SCOTLAND.

By JOHN SPEIR, Newton Farm, Newton, Glasgow.

FORAGE crops may be defined as those crops which are grown for their green leaves, and which in the most of cases are used in the green stage. The word forage is generally applied to those crops only which occupy the ground one year or less, such as tares, cabbages, rape, &c., and rarely to such as meadow fescue, timothy, cocksfoot, &c., which may be used green, but which require to occupy the land more than one year before they are at their best. In the south of England and on the Continent, there are several crops which are undoubtedly pure forage crops, which require more than one season to mature; but in Scotland we have none of any importance, and in this paper the former definition will in the main be adhered to.

General uses.—Forage crops may be grown for consumption at some special time of the year; or they may be grown, as they very often are, because few other crops will mature themselves in the short time that the land for the time being is at the disposal of the farmer. Rape and mustard belong particularly to this class, as they are generally grown as catch-crops after some other and more important crop which is off the land early in the season. Where green food is wanted very early in the season, they may be sown specially to come into use at that time—as, for instance, as food for cows or ewes in milk; or, again, in districts where a scarcity of food is felt, through drought in midsummer, climatic influences in autumn, or an extra supply of stock at any of these dates, then forage crops can be so sown as to come in at any particular date. Most of them also possess the extra advantage of not being necessarily consumed green, if circumstances should arise to render this difficult, as they can generally be made into hay if in midsummer, or silage if in autumn.

The principal forage crops suitable for growth in Scotland are Drumhead cabbages, vetches, Italian rye-grass, clover, rye, rape, mustard, carrot-leaves, gorse, and whin.

Cabbages.—The Drumhead or cow cabbage is the only variety of the cabbage tribe which is specially grown as a forage crop, although the others, when very plentiful and of little value for table purposes, may be economically used as such. The quantity of valuable food which can be produced from an acre of land under Drumhead cabbages is much greater than is generally supposed, and is equalled by few if any other farm crops. They are not very particular as to land, but most particular as to manure; and on the manuring more than the land or climate does their successful cultivation depend. With moderate success they may be grown on the stiffest clays or most porous sands, in the most sheltered situations in the lowlands, or on those exposed and of high altitude, provided their wants as regards manure and cultivation are attended to. Of course, like all other plants, there are situations where they do better than usual; and with cabbages, such places are generally found to be deep, free, well-drained soils. In such situations, more particularly where there is a large proportion of peat, or half-decomposed vegetable matter, as in the dried beds of old lakes and marshes, they produce a wealth of food, which for an equal expenditure of manure and labour cannot be excelled by any other farm crop. Their place in the rotation is after a grain crop. Land intended to be planted with cabbages should in the autumn previous be deeply ploughed, if loam or clay, but if of a more porous nature, such may be deferred till mid-winter or early spring. This deep ploughing should, however, be only done if the land is moderately clean, and in such a condition that no spring cleaning is required. Should the land be more or less foul, it is preferable to plough very shallow in autumn; use the grubber and harrows in March until it is moderately clean, then finish up with a good furrow before drilling. Should the land be of an open texture, it will be easier cleaned in the spring without any autumn ploughing at all, by simply using a very broad-pointed grubber, with the points from 8 to 9 inches broad, to be followed by the requisite harrowings and gatherings, then finishing up with a deep ploughing. Land, however, in any way deserving of the name of foul, should not be planted with cabbages, as the early season at which such land has to be prepared admits of few opportunities of suitable weather for properly cleaning it by grubbing, &c. With suitable weather and free working land, the grubbing process without ploughing is, I am quite convinced, one of the best ways of attaining the result intended; and having cleaned several hundred acres in this way, from the foulest possible state to a condition now suitable to grow garden vegetables, the method proposed cannot be very far wrong.

Drilling should begin as soon as the land is dry enough, any time after the middle of March. The drills should be made about 28 or 30 inches wide, and in every case the farmyard manure should be put *in the drill*. For opening and closing the drills a single mould-board plough, with a long sweeping and narrow-bottomed mould-board or reist, is much to be preferred to the double mould-board plough in common use. Such a plough is much more easily held straight; it works easily in land so cloddy as to preclude the possibility of holding a double mould-board plough with any degree of comfort or success, while it covers the manure much better, as it lifts and turns the earth right over on the top of it, while the other only shoves it to the side. This is not all: with the double mould-board plough the clods are principally left in the centre and on the top of each drill, while with the single mould-board the clods are all tumbled over the top of the drill into the bottom of the next one, the fine earth being left on the top. Drills, therefore, made by the single mould-board plough start small plants or seeds much better than those done by the double mould-board plough, which in a dry spring is a great consideration. Any available quantity of farmyard manure may be used, from 15 to 40 tons per acre. Unless, however, the land is in excessively poor condition, it is not advisable to apply any artificials at this stage; and if it is in very poor condition, a few cwts. of a mixture of kainit and superphosphate may be sown on the top of the manure before the drills are closed, if the quantity of farmyard manure used is at the lowest limit possible. If the weather is suitable, the drills should be rolled with a drill-roller as soon as they are dry enough not to stick to the roller. The rolling makes the work of planting simpler and pleasanter, and assists the plants to take root. If, however, the weather is showery, rolling can seldom be done, in which case it can quite easily be done without, as then the wet assists the plants more in rooting than the rolling would do.

Planting should be begun as soon after drilling as possible, as the young plants always root quicker in fresh-moved soil than in that which has not been stirred for several days. To provide good sturdy plants, a seed-bed on a clean head-ridge of free land should have been prepared the July previous, and the seed sown rather thinly, about the second week of the month. The seed-bed should be kept clear of weeds during autumn, as the smothering effect of weeds, and the moisture engendered by them, do more to kill off the plants in spring than severe weather. Plant-raising is, however, generally done by those who make it a part of their business, and if the plants are brought from a distance, they should be ordered at such a time as to have them at hand as soon as possible after the land is ready. If they have been raised at home—and in many cases they should—they, of course, will be drawn from the seed-bed and planted at once. Planting may be done either with the dibble or the spade—good results may be got with either; the dibble may be considered best for soft easy land, and the spade for firm stiff clays. The great requisite by either method of planting is to see that the soil is firmly pressed around the *roots, not the necks* of the plants, as inexperienced planters are very apt to do. From 18 to 20 inches is a very good width to plant in the drills, although on very good land 2 feet will not be found too wide.

Special manuring may begin as soon as the plants have thoroughly taken root in the ground, or say from a month to six weeks after planting. This should consist of from one to two cwts. of nitrate of soda or sulphate of ammonia per acre, applied in small quantities at the root of each plant. In every case the manure should be mixed with an equal or double quantity of dry earth or sand before sowing, otherwise, unless very great care is exercised, many of the plants will be sure to be killed by an extra quantity being dropped too near them. This should always be applied during a dry sunny day only, as, although it falls in the centre of a plant at that time, it generally runs out or gets shaken out by the wind before gentle rain or dew comes on, and, of course, does no harm. The worst time to apply it at all is when the plants are wet with dew or rain. The earth also keeps the particles of the manure separate, so that it feeds the plant without poisoning it. One cwt. carefully applied in this way will do as much good as three cwts. sown in the usual way along the top of the drill. The usual weedings and horse-hoeings having been performed in due course, the drills should be again grubbed about the time the plants are closing in the drills. The main special manuring should be done at this time, and may consist of from two to three cwts. of nitrate of soda, or other nitrogenous manure, sown broadcast without mixture of any kind. The crop is then ploughed up with the double mouldboard plough, which turns the nitrate which has fallen between the rows of plants, right on the top of the roots and under the spreading leaves, while at the same time it is mixed up with and covered by the earth from the bottom of the drill. Should the following months be wet, the sloping sides of the drill and the spreading leaves of the plants effectually prevent loss or damage from the rainfall; while, if the weather continues dry, the manure is near enough the roots to penetrate down to them. During dry summers cabbages are apt to take on a dull bluish-green appearance, and while in this stage they make very little growth. A good dressing of nitrate of soda or sulphate of ammonia, applied at the time the plants close in the drills, and in the manner above described, assists in a very marked degree in carrying a crop through either a dry or wet period. If the crop has been well grown, and the season is moderately favourable, a beginning of cutting may be made early in October, and from then until the New Year the crop will remain in good condition for use. At first the most matured parts of the field should be used, as the ripest cabbages are always those first and most spoiled by frost. The smaller and greener ones grow considerably between October and December, and unless the frost is very severe and protracted they are rarely much hurt by it before then. The preservation of cabbages after the New Year is a very uncertain proceeding, and none of the methods proposed are very satisfactory; in fact, all are so unsatisfactory that I am inclined to believe they are safer in the field than by any of the methods suggested.

Uses.—Cabbages are well relished by all classes of farm stock, and on them all do well. For dairy cows they hold a first place, either for the production of milk or butter, but for the latter it is well to see that no decayed leaves are given to the cows, because, although fresh cabbages give no deleterious flavour to either butter or milk if used in any reasonable amount, still a very small proportion of decayed leaves may taint either. As a rule they are fed to dairy cows once or twice a-day, and generally raw, although occasionally dairymen here and there prefer to use them boiled or steamed. The general opinion, however, is that such is unnecessary, and the labour is certainly very much less. Feeding cattle of all kinds also do well on them, also so do sheep. During frosty weather sheep, or for that matter of it any kind of stock, should only have them in very limited quantity, otherwise loss through inflammation of the stomach or intestines is almost sure to follow.

The growth of forage crops appears at first sight to be more part of the routine of the arable farmer than of the dairy farmer, but the arable farmer can rarely turn them to so good account as the dairy farmer; I am therefore inclined to think their growth is a matter more deserving the attention of the latter than the former. I am also strongly of opinion that arable farming, combined with the production of beef or mutton, should go hand in hand with dairying. Any farm kept principally in crop, unless in the immediate vicinity of a large town, must keep a large head of feeding stock to consume the fodder raised, and produce manure; and where such stock is bought in every autumn, any profit realised on its keep depends more on the respective values at the time of buying and selling than on the food consumed. The profit on feeding is always very little, because if fat sells well, stores are costly in proportion to purchase, or if keep is plentiful, everybody wants store stock, and the price rises, so that unless there is a corresponding rise in the price of fat, there is little gain from the produce consumed. In the most of cases, if the fattened animal sells for more than it has cost to bring it to the block, the bulk of the extra profit goes to the raiser, not the feeder, with a fair and often a large share to the dealer. This is not as it should be. My idea, and that of many others who have devoted considerable attention to the subject, is, that the most will never be made out of such farms until they breed and rear, if not all, at least the bulk of their own feeding stock. Before such can be bred we must have cows, and to keep a large number of cows involves the keeping of a dairy. To me, therefore, the ideal farm under such circumstances should possess a herd of cows of sufficient size to provide as many feeding beasts as are requisite to consume the roots, fodder, and a portion of the grain of the farm. The cows may be of any breed easily procured in the district, and if pure bulls of the shorthorn or black polled breed are used, the progeny are sure to fatten well, as has already been proved in hundreds of cases. In the drier districts of the east coast, where pasture often does not do well, forage crops can be grown to perfection, and between the pasture and the forage, a system of farming might be inaugurated, comprising dairying, breeding, rearing, feeding, and general arable farming, which would give results far beyond those attained in most feeding localities. Such a class of farming would give more steady employment for the labourers on the farm, a better class of stock would be produced, the farmer would receive the profit of the rearer, middleman, and transit companies, the country would run less risk from pleuro-pneumonia and other similar scourges, and I think everybody would be benefited all round.

Vetches.—The premier position as a forage crop for Scotland I give to Drumhead cabbages; the second I accord to vetches. Vetches, like cabbages, may be grown on almost any kind of land, and with judicious preparation on all alike successfully. Like cabbages, their growth depends more on manure than on land, but the manure which is suitable for the one, is quite unsuited for the other. Their place in the rotation is after a grain crop, or part of the green crop break. Clean land need not necessarily be selected, although it will be all the better of being clean. Early in the autumn, it should receive a light dressing of farmyard manure, say from 12 to 15 tons per acre, spread on the surface. This should be allowed to lie exposed for some weeks before the land is ploughed, and any time during the interval the land should be manured with not less than 5 cwt. of kainit and 2 cwt. of superphosphate per acre. After this has been washed into the soil for a week or two, the land may be ploughed about 6 or 7 inches deep, not more, it not being advisable to put the farmyard manure far from the surface, as it is when the plants are young that it exercises its principal effect on them. Any time after ploughing, another manuring of, say, 4 cwt. of kainit and 1 cwt. of superphosphate should be sown broadcast over the surface. In any climate, and on any land, there is no fear of any appreciable amount of this kainit or superphosphate being washed out of the soil, as only infinitesimal quantities of the principal manurial ingredients in these manures are found in the drainage waters. If the land is moderately clean, no other preparation will be necessary before sowing the seed. Should, however, the land be foul, a slightly different course may advantageously be followed. Early in autumn, the land should be ploughed as deep as possible, the furrows being well thrown over on their back. Deep ploughing, as a rule, does not kill weeds, but weeds, if buried deeply and then covered with a thick crop, make very little progress indeed. If the land is of a porous nature, or deep loam, the work can be more satisfactorily done by two light ploughings than one heavy one. After an ordinary furrow has been opened, any variety of light plough with a broad thin flat and sharp sock or share, and drawn by one horse, should turn a furrow 10 or 12 inches broad, and from 2½ to 3 inches deep, into the bottom of the furrow previously drawn. An American Oliver plough should then follow in the same track as the previous plough, and throw over from 6 to 7 inches of soil on the top of the sod previously turned into the bottom of the furrow. For this class of work the Oliver plough far outstrips any pattern of our home-made ploughs, as their peculiarity of throwing the earth so far off the mould-board covers up the sod furrow much better and with less labour than any of our home ploughs. Any time after, when the land is dry enough to carry the horses, it may receive a stroke of the harrows, and the kainit and superphosphate can be sown as soon as opportunity offers. Advantage should be taken of the first touch of frost which comes, to cart on to the land the requisite amount of farmyard manure, which should be spread as carted out and not allowed to remain in heaps. After a few weeks' exposure, or any time the land is dry enough to carry the horses, the dung should be ploughed under with as thin a furrow as possible, and the kainit and superphosphate sown on the surface as before.

On dry land and in any moderately early district, vetches may be sown any time between the first of February and the middle of June. About 2½ to 3 bushels of seed is quite sufficient for an acre, rather more being sown at the very beginning and end of the season than at the middle. It is always advisable to mix the seed with about half a bushel of oats per acre, and if any beans are at hand, one-eighth or one-fourth of a bushel per acre assists considerably in keeping up the crop. If the plough furrows are still very prominent, and afford apparently ample depth to cover the seed, it may be sown broadcast; but if there is likely to be any difficulty at all about covering the seed, then it should by all means be put in with the drill. Pigeons are very fond of the seed, and if it is exposed or insufficiently covered, they will carry it totally away. Many failures of vetches, particularly small plots, are accounted for in this way. If a drill is not at hand, the land may be run up into narrow drills, say 18 inches wide, and as soon as finished, one half of the seed sown broadcast over the top. The drills are now split with the double or single mould-board plough and the other half sown, when a double stroke of the harrows will cover it and complete the operation. Land sown with vetches should always be carefully rolled so as to give as smooth a surface as possible, because they lie so close to the ground, that unless the surface is very smooth, they are most difficult to cut.

In an average year vetches sown in February should be ready to cut about the first week in July, and if sown in small patches at intervals of three or four weeks, they may be had in good condition during the months of July, August, September, and October. They are plainly, therefore, a crop for consumption during summer and early autumn. They are probably the richest of all the forage crops, their proportion of albuminoid matter being very large. The weight which can be raised from an acre is less than that of cabbages, but when the feeding value alone is taken into consideration the difference is not so much in favour of the cabbages, while the vetches are grown at considerably less expense. They have also one advantage over cabbages, in that, if more of them are grown than can be consumed green, they can be turned into hay or silage, and they make excellent feeding in either form.

Vetches of the quality shown in the subjoined analysis, made into hay and secured without any deterioration, are a most valuable food, and two tons of such should be equal to about three tons of timothy hay made under similar conditions. In our climate vetches are risky to make into hay, and unless the weather is very settled, better results will be obtained by making them into silage. If, however, vetches are to be made into silage, they should be cut a little earlier than if they were intended for hay, as, when the stalks become too hard, they do not press well together. If cut before any pods become filled, they may be put into the silo or silage stack as they are cut; but if much ripened, they will press better to be passed through the chaff-cutter before being put into the silo.

The following is a very complete analysis of Scotch vetches made for me during the past summer by David Wilson, Esq., jun., Carbeth, Killearn, with his notes thereon:—

SAMPLE OF VETCHES RECEIVED 9TH AUGUST 1889.

	In 100 parts of		
	Green Vetches as received.	Dry Matter of Vetches.	Vetch Hay with 14.3 per cent of water.
Water	83.56	...	14.3
Digestible albuminoids	1.74	10.59	9.07
Indigestible albuminoids	.94	5.70	4.88
Non-albuminoid nitrogen × 6.25	1.20	2.28	6.24
Fat, wax, and chlorophyll	.23	1.41	1.21
*Extractive matter free of nitrogen	5.99	36.43	31.23
Ash	1.49	9.07	7.77
Woody fibre	4.85	29.52	25.30
	100.00	100.00	100.00
Total nitrogen	.62	3.77	3.23
Equal to crude protein	3.88	23.57	20.20
Non-albuminoid nitrogen	.191	1.163	.997
Percentage of total nitrogen non-albuminoid	...	30.85	...
Percentage of true digestible albuminoids	...	65.01	...
Comparative value (cocksfoot in bloom = 100)	...	150.	...
*Containing starch and sugars = grape sugar (average of two analyses)	2.85	17.33	14.85

"The above analysis may be compared with those made here on other plants of the same species. This sample of vetches is richer in albuminoids than lucerne cut at the same stage, but in other respects it closely resembles that plant in composition. A larger proportion of the nitrogen in this sample is non-albuminoid, than in clovers; there, however, remains in the more valuable form of true albuminoids, a greater percentage than is generally found in clovers, cut in full bloom, and as great a proportion of these albuminoids was proved to be digestible with artificial gastric juice. On the other hand, the woody fibre is considerably greater in the vetch than in clovers."

Vetches being off the land earlier than almost any other crop, a good opportunity is afforded for cleaning it before putting in another crop. This may be done immediately after the crop is removed by grubbing and harrowing, if a good job is wanted to be made, or the land may be simply ploughed and left fallow till the ordinary time of sowing wheat, or other crop which it is intended should follow. It has now been proved, almost beyond the possibility of a doubt, that Hellreigel's theory about the warts on the roots of vetches and other leguminous plants being direct manufacturers of nitrogen, is correct, so that a new impetus should be given to the growth of vetches. Nitrogen is our most costly manurial ingredient, and, according to this theory, the land should, and as a matter of fact appears to be richer in nitrogen after a crop of vetches than before.

Italian Rye-grass.—This grass, although quite hardy in any part of Scotland, attains its greatest luxuriance on the deep, well-tilled, and highly manured lands of the earlier districts. This is not to be wondered at, for, being a native of the sunny plains of Italy, the wonder is it stands our winters at all. After growing one winter and the following summer, it generally dies in whole or in part the following winter, although occasional plants of it appear to grow on for several years. The seed may be sown in the autumn from August to September, or in the spring, with or without a grain crop. If in the autumn, its place in the rotation is usually after a potato crop lifted green. It can also with advantage be sown after vetches cleared off in July, August, or September. In every case the seed should be buried much deeper than most farmers are accustomed to sow grass seeds. It brairds well at any depth from ¼ inch up to 1¼ inch, and even at 1½ inch the percentage of germinating seeds will be several times greater than if sown on the surface. The seed should therefore be sown on the unharrowed or partially harrowed land, if very rough, and not on the smoothed surface, as is the usual practice. From one to two bushels of seed are usually sown per acre, some districts favouring the thin seeding and others the thick seeding. Although an advocate of comparatively thin seeding generally, as applied to grain-growing, I must admit I prefer thick seeding with all grasses. Deep-seeded plants, besides rooting quicker and standing dry weather better, also stand repeated frosts and thaws much better than shallow-seeded ones; for while the shallow-seeded plants are thrown out of root in spring by the thousand, few of the deep-rooted ones are hurt at all.

Italian sown in the spring or autumn of one year is capable of producing, on deep, well-manured land, a most prodigious crop the year following. It is a gross feeder of nitrogenous matters, and unless it is provided with these in abundance, the return will not be much greater than from ordinary rye-grass; while if provided with them in sufficient quantity, it will yield double or triple the produce of the ordinary variety. It is the king of grass for sewage manuring, and under such a system three or four heavy cuts can easily be produced in one season.

If sown after early potatoes, and heavily dressed with nitrate of soda or sulphate of ammonia in spring, it may be continuously cut from May to November, by top-dressing, after each cut, with from one to two cwts. per acre of nitrate of soda or sulphate of ammonia. If each crop is cut green as a forage crop, little difficulty will be experienced in getting three fair cuts in the better districts of the country; while if the first is used as forage or made into hay, a good second crop may be obtained on most arable land at an expenditure of £1 per acre for nitrate of soda, which will make a useful forage or silage crop, and leave such a quantity of roots in the soil, as almost to ensure the success of the following grain crop. Where so manured, it attains a length almost as long as grain; and before me at present I have a sample cut during the present dry summer, from deep river-side land, the average length of which I find is 5 feet, with a few stalks a little longer.

As a forage crop, Italian is principally used for the feeding of milch cows or other cattle confined in the house. Owing to its succulent nature it always encourages a good flow of milk, when fed to dairy cattle. Without any other feeding the milk produced would necessarily be very thin; but by judicious concentrated foods the dairyman can easily improve the quality of his milk and the condition of his cattle, when he has got them to produce enough in quantity.

Clovers, and more particularly *red clover*, are well suited for cultivation as forage crops, but, unfortunately, over a great part of Scotland only a very small percentage of the seeds sown ever attain to be matured plants. In many cases a large proportion of the seeds never take root after germinating, many more die during winter, so that few persons can say, when they sow clover seed, what sort of crop is likely to be produced. Many causes may contribute to this. Seeding on or very near the surface appears to be one cause, disease in the shape of eel worms (*Tylenchius devastatrix*) causing a malformation similar to tulip root in oats, and finally the death of the plant; but the most important of all appears to be manuring or the previous cultivation of the land. Another cause, which may ultimately have some bearing on the question, is the presence or absence of the nitrogen microbe or fungus which causes the warts to grow on the roots of leguminous plants. As is to be expected, some seasons favour the growth of clovers, while others are hurtful to them.

In Scotland, where clovers are usually sown with a grain crop, it is generally considered they succeed better after barley than either oats or wheat; but whether it is the crop which causes this effect, or the class of land on which that crop happens to be sown, I am not prepared to say; but I have a suspicion the difference is more in the land than the crop. Another point which has been repeatedly noticed is, that land which has received a slight dressing of stable manure before the wheat crop was sown, almost invariably produces a good clover plant. Again, on the farm of Burn, parish of Dalry, Ayrshire, where I was born, there are several spaces of an acre or so, where heaps of blackband ironstone had been calcined, the extreme heat from which charred the clay soil from nine inches to a foot down. Some of these places were ploughed up immediately after the charred ironstone was removed, in others it was not done for several years after; but in every case clover has always grown profusely and luxuriantly on these places, and continues to do so to the present day, it being fully thirty years since the first of them was broken up. The places are cultivated in the same way as the rest of the field, and when sown with grasses they appear to be all clover and no grasses, while the remainder of the fields only contain a sprinkling of clover, the bulk being grasses. On the same farm several bleeze or shale heaps—refuse in taking out the ironstone—have been partially levelled and cultivated for about thirty years, and on these clover always does well, producing extra heavy cuts. Here also a piece of land which has been continuously under cultivation for a very long time, and which has received no farmyard manure for fifteen years, but which has all along received the same kind and quantity of artificials, has produced, in September, from seed sown in the spring, the following weights:—

CLOVER

On experimental plots at Newton Farm, 1889.

No.	Manure used annually.	Tons per acre.			Avge. per acre.		
		tons	cwts.	qrs.	tons	cwts.	qrs.
II.	Nothing	3	6	0	3	6	0
VII.	No potash, but 2½ cwt. nitrate of soda and 5 cwt. 26 per cent superphosphate	4	5	0	4	6	3
XIX.		4	8	2			
VIII.	No phosphoric acid, but 2½ cwt. nitrate of soda and 5 cwt. kainit . . .	7	0	0	6	7	2
XVIII.		5	15	0			
IX.	No nitrogen, but 5 cwt. kainit and 5 cwt. 26 per cent superphosphate . .	7	8	2	7	3	2
XIX.		6	18	2			
X.	Full manure, 2½ cwt. nitrate of soda, 5 cwt. superphosphate, 5 cwt. kainit . .	5	12	0	5	16	1
XX.		6	0	3			

The soil of these plots is a sandy loam lying on sand and gravel. The crop grown, as a rule, has been changed every year, and this is the first year clovers alone have been sown, although leguminous plants have been grown before. There is a good plant over all the plots. A very noticeable feature in them was that the plots receiving no phosphoric acid, up to the middle of July looked as if they would have produced no more than, if as much as, the unmanured plot. Up to that time the no potash plot looked quite healthy; but from that forward the latter went back every day, while the former went forward.

These few remarks, although a little digressive, show the difficulties to be encountered in growing clover as a forage crop, and although the plant, when it does well, is particularly well suited for such, still, owing to the risks presently accompanying its cultivation, my experience does not warrant me in recommending it to be extensively grown as a purely forage plant. When sown with rye-grasses as a hay crop, it occasionally produces a very heavy second crop. Unfortunately this second crop cannot be very much increased by artificial manuring; the farmer can only utilise it if it grows, but he cannot force it. A good second cut of clover may be utilised as a forage crop, or if not required as such, it makes excellent and easily made silage.

Rye makes only a second-rate forage crop as far as quality is concerned, although it bulks well enough, and is easy of cultivation. It should be sown at the rate of about 3 bushels of seed per acre between the latter half of August and the end of September. Its place in the rotation is to come in after early potatoes or some other crop which has been cleared off the land about that time. No special manuring, preparation, or cultivation is required for it, ordinary ploughing and harrowing being usually sufficient. If sown at the end of August, it is usually ready to cut about the end of May. It does not keep in good condition for use as a forage crop for over three weeks, as the straw very soon becomes hard and harsh. It grows, however, to such a great length in so very short a time, that on comparatively poor land it yields a big crop before anything else is ready. It is useful for giving to any class of stock, but whenever the bottom of the stalks becomes hard, most animals leave more or less of it.

Winter Tares.—These make an excellent forage crop in the south of England, but in even the best districts of Scotland they are very risky, as they seldom stand the winter well. In even the most favoured districts of Scotland they should not be sown by themselves, but with a portion of rye, as the latter is extra hardy, and the shelter of the rye helps to preserve the tares. The tares, or tares and rye, should always be sown as early as possible, the best time being between the middle of August and the first week in September, but not later, unless the weather be exceptionally mild. The succulence of the tares considerably qualifies the harshness of the rye, and makes the latter much more palatable for the stock.

Rape.—Where any crop has been removed between the first of July and the middle of August, and sheep feed is wanted in the end of the year, few crops are got in with less trouble and at less expense, with a fair prospect of a moderate return, than rape. On a large extent of the early potato lands of south Ayrshire it is extensively sown, and first-class sheep feed it makes. As a rule the seed is sown broadcast on the undug potato drills, as much being sown each day as it is calculated shall be dug before night. During the operation of digging the potatoes, the seed gets regularly scattered over the land, while at the same time it is thoroughly covered, so that all ploughing, harrowing, and carting off shaws are avoided, the green shaws being allowed to lie and rot. Those farmers, however, who grow potatoes for the early market, find that although they can repeat their potato crop on the same land, with only very short intervals, with impunity, yet they cannot do so with the rape, for after a very few years it becomes so infested with finger-and-toe, after the manner of the turnip, that a remunerative crop cannot be grown. Rape is generally fed off with sheep.

Mustard.—Where rape is subject to finger-and-toe, mustard forms a very suitable crop for growing in its place. It grows very rapidly, and produces a good fair bulk of food, which is generally used as sheep feed. It, however, is not so palatable to them as rape; yet when they become accustomed to it, they do fairly well on it. Both it and rape are very suitable for growing after any midsummer crop: as the cost of seed is small, the cultivation required is almost nothing, while the crops can be used in any stage of their growth, should cold weather set in before they have attained maturity.

Carrot-leaves.—Where carrots are grown, the leaves form an excellent class of food for any kind of farm stock, and one of which all are passionately fond. A well-grown acre of carrots, I expect, should yield at least 5 tons of leaves; and as far as my experience goes in the use of them—and it now extends over fourteen years—I am inclined to believe them of more value, weight for weight, than ordinary turnips. This is not the universal opinion of them, the popular opinion being very much in favour of the turnip. This I account for by the fact that few farmers grow carrots, and therefore only these few have the opportunity of testing their value. The following analysis by Professor Stewart shows the comparative value of carrot-leaves, turnip, and ordinary pasture-grass:—

	Carrot-leaves.	Turnip.	Pasture-grass.
Water . . .	82.2	92.	80.
Albuminoids . .	2.2	1.1	2.5
Carbohydrates . .	7.	6.1	9.2
Fat	.5	.1	.4

These analyses only state in a general way what the component parts of each substance may be, but should never in any case be considered as actually what are likely to be got from examples of each food, grown probably under widely different conditions of soil, climate, and manuring. Judging from these analyses alone, one would say carrot-leaves were better than turnips, and much the same as good pasture-grass; and my experience of them places them in about that relationship. It therefore seems strange that many farmers should allow such a valuable food as their carrot-leaves to be simply spread on the land as manure. They have not the extreme purging effect of either turnip-tops or mangel-leaves; it, however, is there all the same, but not to a greater extent than is present in young pasture-grass in spring. They have also another advantage: farm stock of all kinds—horses, sheep, and cattle—are extremely fond of them, and will take to them at once without any preliminary training. They should be consumed as soon after they are shawed as possible, as they are then better relished by stock. If pulling of carrots begins moderately early, the carrot-leaves may be had in good condition for from one to two months. As the season of the year is then generally damp and cold, they remain usable for one or two weeks after being shawed if left in very small heaps.

Gorse, Whin, or Furze.—Of all classes of winter green fodder this is probably as concentrated a one as any; but owing to the difficulty of handling it, it never has been, and is never likely to be, any great favourite with the public. It is never grown as a regular rotation crop, it being more a permanent or semi-permanent one than a rotation one. It is usually sown on thin, bare, sandy, or gravelly land, in exposed situations, where few other crops would do well—in fact, few situations are so exposed that it will not do well, other conditions being satisfactory.[1] Stock eat it with a fair amount of relish after it has been prepared for them; but in its natural state only extreme hunger will compel them to partake of it.[2] Its composition is more constant than that of most forage plants, although it varies considerably with the time of the year at which it is cut and its age; but the following may be considered a fairly average sample:—

	Gorse.	Pasture-grass.
Water	72.	80.
Albuminoids	3.2	2.5
Carbohydrates	8.2	9.2
Fat	1.1	.4

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[1] The seed may be sown either broadcast or in narrow drills.

[2] The whole crop should be annually cut with the scythe or mower, otherwise it becomes too hard to be of any use as fodder.

From this it will be seen that, as a green food stuff, it ranks very high; and being used only in winter and spring, it comes in then very handy as a fresh green food. Before being given to stock, it should be bruised with flat wooden mallets, or through what Messrs Mackenzie & Co. of Cork call a masticator, which bruises and cuts the sharp, hard spines, in which condition it mixes readily with any artificial food.

Prickly Comfrey.—About ten or twelve years ago this plant was prominently brought before the public as being the king of forage crops, but experience of its growth and use since then do not bear that out. More particularly in Ireland an attempt is again being made in its favour; but I fear it will not succeed. On two occasions, at an interval of three years, I have received a fresh stock of this plant from separate seed establishments, because persons calling themselves experts regarding it, said I had been supplied with the wrong variety. In neither case, however, was the experiment successful, at least as far as consumption by stock was concerned. It is easy of culture, not very particular as to land or manure, but delights in a deep rich loam, and produces a weight of crop likely to please the most exacting; but after all, what is it worth, when stock will not eat it? In my case I persevered with it given to milch cows, but unless when very young, and when no other green food could be procured, they would not eat it. When anything else in the shape of grass could be got, they absolutely refused to take any of it. Many of my neighbours, within a radius of a few miles, also tried it, and all had an exactly similar experience. Pigs, I find, are fonder of it than any other class of stock, but all that can be used in that way is comparatively little.

It is generally planted in rows from 30 to 36 inches apart, and about the same from plant to plant in the rows. Sets or cuttings of the roots are usually employed in making new plantations, a very small part of a root being sufficient for each stool. At first it must be kept free of weeds by hand and horse hoeing, but after the plants are thoroughly grown they smother out all weeds. It is usually cut with the scythe, and may produce from 20 to 60 tons an acre.

A new plant (*Lathyrus sylvestris Wagneri*), or at least an improved variety of an old plant, has during the past year been exposed for sale to the public. It is said to produce a better quality of and greater weight than any other forage crop in the market. It is introduced by Professor Wagner of Darmstadt, who is said to have raised it from the ordinary field vetch by selection and cultivation. The reports regarding its capabilities are something wonderful, but until they are in part or in whole verified by trials in this country, I would advise all concerned to receive them with extreme caution. I have sown a small portion of seed, and made a small plantation from plants imported direct from the introducer, but as far as my experience yet goes, the results do not warrant me in recommending it.

THE CEDAR OF LEBANON (*CEDRUS LIBANI*), AND ITS PROGRESS AND SUITABILITY AS A FOREST AND TIMBER TREE IN SCOTLAND SINCE ITS INTRODUCTION. WITH APPENDIX OF STATISTICS OF OLD AND REMARKABLE CEDARS IN SCOTLAND.

By ROBERT HUTCHISON of Carlowrie.

Cedrus libani, Barrelier, cedar of Lebanon. Syn. *Pinus cedrus*, Linnæus; *Abies cedrus*, Poiret; *Larix cedrus*, Miller; *Larix patula*, Salisbury; *Larix orientalis*, Tournefort; *Cedrus phœnicea*, Renealm.

Leaves—simple, very dense, in alternate tufts, of about thirty in number, evergreen, rigid, partially four-sided, or cylindrical, tapering to the point, straight, 1 inch in length, sharp-pointed, and of a dark grass-green colour. Branches—horizontal, with the branchlets disposed in a flat fan-like manner on the branches, very numerous, and thickly set with leaves. Cones—erect, ovate, flattened at the ends, and depressed, from 4 to 5 inches long, and about 2½ inches wide, with a longish footstalk, of a greyish-brown colour, and remaining firmly attached for years to the branches. The cones do not ripen until the second year, and exude, while growing, considerable quantities of resinous matter. Scales — flat, and firmly pressed against each other, 1½ inch broad, obtuse, and truncated at the summit, very thin, leathery, slightly denticulated at the edges, and of a reddish colour, shining on the flat part. Seeds—somewhat triangular, soft, and surmounted by a broad and very thin membranaceous wing more than an inch in length.

Grows with wide-spreading horizontal branches, and attains a height of from 60 feet to 80 feet high, and 30 feet in circumference, with a flat tabular top when old.

The original habitat of the cedar of Lebanon seems to have been somewhat circumscribed within a comparatively narrow area. Mount Lebanon, whence its name is derived, appears to have been its cradle; for here, undoubtedly, the oldest trees are still to be found, although they are now few in number, and are year by year decreasing. We have the reports of successive travellers at various dates down to the present time. Belon is probably the earliest whose record we possess. He visited the spot in 1550, and states that "at a considerable height up the mountain, the traveller arrives at the monastery of the Virgin Mary, which is situated in a valley. Thence proceeding four miles farther up the mountain, he will arrive at the cedars—the Maronites, or monks, acting as guides. The cedars stand in a valley, and not on the top of the mountain, and they are supposed to amount to twenty-eight in number, though it is difficult to count them, they being distant from each other a few paces. No other tree grows in the valley in which they are situated; and it is generally so covered with snow as to be only accessible in summer." Of a later date are the reports of other travellers to this venerated shrine of the relics of Biblical times, the elegance and majesty of whose appearance have frequently been extolled in sacred writ, beyond that of any other tree. Thus in 1570 Rauwolf visited these cedars, in 1655 Thevenot mentions them, and in 1696 Maundrell describes them, also in 1702 Bruyer, in 1722 La Roque, and in 1745 Pococke, and others more recently all bear record to the existence of the lingering remains of what evidently has been an ancient forest in the highest part of the mountain, which has gradually, by the hand of time through countless ages, become reduced to a single clump of very aged and enormously large cedar-trees. In 1832, the grove, or forest as it might still be called, was visited by Lamartine, who describes them as "the most renowned natural monuments in the universe."[1] "The Arabs of all sects entertain," he says, "a traditional veneration for these trees. They attribute to them not only a vegetative power which enables them to live eternally, but also an intelligence which causes them to manifest signs of wisdom and foresight, similar to those of instinct and reason in man. They are said to understand the changes of seasons; they stir their vast branches as if they were limbs; they spread out or contract their boughs, inclining them towards heaven or towards earth, according as the snow prepares to fall or to melt. These trees diminish in every succeeding age. Formerly travellers counted from thirty to forty; more recently, seventeen; and more recently still, only twelve." Now, it is said, only seven of the original forest remain. In 1836, the mountain was visited by M. Laure, an officer of French marine, with Prince de Joinville, who found fifteen of the sixteen old cedars mentioned by Maundrell, but all in a very decaying state: one of the most intact of the old trees, but perhaps the smallest, measured 35 feet 9 inches in circumference. Around these ancient witnesses of former generations, there still remains a small area of younger and rather yellower looking cedars, containing from 400 to 500 individual trees; while, surrounded by the old trees, are about forty comparatively young trees, girthing each from 10 to 12 feet in circumference. The soil of the forest of Lebanon, on which not a single blade of grass was growing in September 1836, was then covered to the depth of half a foot with the decayed leaves, cones, and scales of the cedars, so that it was next to impossible for the seeds of the trees to reach the ground and germinate. But although, as we have said, the cedar of Lebanon appears to have been cradled in that mount, it is now found abundantly, although not in trees to be at all compared with the original Biblical trees we have referred to, probably over the entire group of mountains situated between Damascus and Tripoli, in Syria, and which includes the Libanus, and Mounts Amanus and Taurus of antiquity: its distribution also on the mountainous regions of the north of Africa is extensive, and appears to have been so from early times.

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[1] See Selby, p. 529.

According to the author of 'Hortus Kewensis,' the cedar of Lebanon was introduced into England as late as 1683, when four specimens are known to have been planted in Chelsea Botanic Garden, and frequent reference to their progress and history is to be found in the pages of arboricultural writers from time to time since their advent. Indeed, the interest with which their growth seems to have been watched, clearly proves that they were a new species whose introduction was heralded into this country, as likely to form a new feature in the arboriculture of England, and to add another important and valuable timber tree to our *sylva*. Selby, it is true, writing in 1842, considers that the size of the two surviving members of this quartette points to a somewhat earlier introduction; but even he is clearly of opinion that it cannot have been growing in this country until after the reign of Queen Elizabeth, and that it may have been just brought under the notice of British planters by Evelyn. The latter in his 'Sylva,' published in 1664, commends it as a beautiful and stately tree, and adds that "it grows even where the snow lies, as I am told, almost half the year, for so it does, on the mountain of Libanus, from whence I have received cones and seeds of the few remaining trees. Why then should it not grow in Old England?" We may assume, therefore, that no cedar flourished under an English sky till long after Shakespeare's death. His acquaintance with the tree, and he mentions it frequently, must have been based on Biblical references, and, as all know, it stands pre-eminent for dignity and importance in the catalogue of Bible dendrology. Old Gilpin quotes, as the most complete word-picture ever depicted, the passage referring to the cedar of Lebanon in Ezekiel xxxi. 3-9, which will show that the language of the prophet is unique as a description of a forest tree.

There can be no doubt that the cedars at Chelsea, and several of those in the Duke of Devonshire's grounds at Chiswick, others, as the Enfield cedar, and those at Sayes Court, Deptford, may be reckoned amongst the earliest introductions into England. But the greatest planter of the cedar in its earlier days in Britain was the Duke of Richmond, who, as Collinson informs us, introduced many hundred plants in his grounds at Goodwood. We have the following memorandum from Peter Collinson, in his copy of Miller's Dictionary, on the subject in 1761: "I paid John Clarke" (a butcher at Barnes, who was very successful in rearing cedar and other foreign trees) "for 1000 cedars of Lebanon, 8th June 1761, £79, 6s., on behalf of the Duke of Richmond." These were planted when five years old, in March-April 1761. In September following, when at Goodwood, he saw them, and reports them as in a thriving condition. In October 1762, another large payment is recorded to Mr Clarke for a further considerable supply of young cedars to the Duke. Of these cedars at Goodwood, we learn that in 1837 still 139 remained. Shortly after their introduction by the Duke of Richmond, many other landed proprietors appear to have shared in the mania for the extensive planting of the cedar, and its propagation and dissemination became general, till in 1766, when cones appear to have been ripened in the Chelsea Botanic Gardens, and since then, partly from imported seeds and from cones ripened in this country, the tree was extensively multiplied, and there were comparatively few demesnes or gentlemen's policies that did not boast several specimen trees. Many of these are still to be seen scattered over the various counties of England; and as an ornamental tree of true majestic bearing, and frequently of colossal proportions, the cedar would appear to have flourished in England, rather than as a timber tree planted with a view to profit, or economic culture.

The earliest recorded cedars of Lebanon in Scotland appear to have been planted at Hopetoun House, which, it is stated, were introduced in 1740 by Archibald, Duke of Argyll, who brought them, with many other exotics, such as tulip-trees and other evergreens, from London. Mr Smith, the gardener at Hopetoun, and an enthusiast in pines and other forest trees, writing in 1834, states that these cedar-trees "are the fastest growing trees on the estate." The largest then measured nearly 15½ feet in girth at 1 foot from the ground, and was 68 feet high. We have similar records of the rapidity of the growth of the cedar of Lebanon, when about from twenty to sixty years of age, and as to its outstripping other Coniferæ of similar age; yet it is strange that its introduction as a timber tree has not been more general, for there can be no doubt of its hardihood or suitability to almost any soil and situation in this country. We must refer to this peculiarity at a later portion of this paper. Meanwhile let us glance at the progress which some of the specimens introduced into Scotland, and still surviving in various counties and altitudes, have attained. In the appendix attached to this paper we have collected, at considerable trouble, and have now tabulated, the growth and condition of the best specimen trees throughout Scotland. Although the cedar has been planted in many localities in the northern counties of Scotland, we have no record of any having been tried in any of the woods of upper Deeside; indeed, we have it on the authority of Mr Michie, her Majesty's forester at Balmoral, that there are none in that district. We find it, however, in many other northern localities in other parts of the Highlands of Scotland. The largest trees are at Beaufort Castle, the seat of Lord Lovat, in Inverness-shire. By the kindness of Mr Dewar, forester at Beaufort, we are enabled to give the accompanying information as to their details. Originally planted in 1783, and allowing them to have been four years old at that time, their age would now be (1889) 110 years. One of these cedars suffered a good deal about twenty years ago from a severe snowstorm, yet it still increased 18 cubical feet of timber in four years, while during the same time another tree made 28 cubic feet. The largest cedar now existing at Beaufort Castle contains nearly 300 cubic feet of timber. At Brahan Castle, in Ross-shire, we find the cedar of Lebanon in a light black loam, upon sandy clay, at an altitude varying from 160 feet to 220 feet, planted 150 years ago, in vigorous health, and girthing at 5 feet from the ground 11 feet 7 inches; while at Tarbat, at only 15 feet altitude, in a heavy loam upon clay, it is also very healthy, and girths over 7 feet at 3 feet from the ground, planted on the occasion of the coming of age of the last Earl of Cromartie, sixty-two years ago. Again, in Forfarshire, we find at Gray (Liff parish) two fine large and remarkable cedars. Planted 250 years ago, according to accurate records, one is now 73 feet high, with a bole of 26 feet, and girths 14½ feet at 3 feet from the ground, and contains 505 cubic feet of timber. Another in same site, although only 55 feet high, girths at 3 feet, 17 feet, and divides into four large limbs which are trees themselves, and contains 323 cubic feet of timber. They grow in a black loam soil, with a subsoil of sand and gravel. The altitude is 100 to 120 feet. These trees are mentioned by Loudon in his 'Arboretum,' and are probably amongst the earliest introductions of the species to Scotland. At Camperdown, at an altitude of 370 feet, we find it quite vigorous, and very characteristic in habit, 47 feet high, and girthing 7 feet 7 inches at 5 feet from the ground. Probably from its higher site it has, in this situation, assumed more of the peculiarities of its ancestors in their native habitats, for its dense and flat-headed type of growth in the upper branches is quite striking, and corresponds with the form it assumes in other high altitudes in various localities in our recorded statistics, as at Murdostoun, in Lanarkshire, altitude 500 feet; Loudon Castle, Ayrshire, altitude 245 feet, where in sandy loam soil it has attained a girth of 14 feet 11 inches at the ground, and 14 feet 7 inches at 5 feet; and at Whittinghame, 300 feet altitude, where we find it 53 feet high, and about 10 feet at 1 foot from the ground, and 7 feet 3 inches at 5 feet above ground. A fine specimen may be seen at Culross Abbey, on the shores of the Forth, with a majestic spreading head, having a diameter of 125 feet, and 50 feet in height. This fine tree divides in its bole at 12 feet from the ground into two large limbs, which girth respectively 6 feet and 6 feet 3 inches. The tree is still growing, and making wood annually. It is undoubtedly a very old tree; there is no accurate record of its age or when planted; but there is a common tradition that it was grown from a seed planted by the walls of the old abbey by a monk from the Holy Land. The venerable appearance of the tree, and the care with which the site has been chosen for it and itself tended and sheltered, all point to the regard in which the tree has in times gone by been held, and lend a colour of truth to the tradition of the country-side. In early times the family of Preston, through several of their ancestors, had frequent intercourse with Palestine and the East.

In the grounds at Dunkeld there are several fine specimen cedars. The tallest is about 55 feet high, and girths at 3 feet, 11 feet 6 inches, while another of the species, or a variety only —probably *Cedrus atlantica*—is now nearly 30 feet high, and girths 3 feet 4 inches at 1 foot from the ground. It was planted by Queen Victoria on 13th October 1865, and is carefully tended, and known as "The Queen's Cedar." Other good examples of the *Cedrus libani* are to be found in Perthshire—at Ochtertyre, where many abound, girthing nearly 10 feet at 1 foot from the ground, and very vigorous. Indeed, we find the *Cedrus libani* planted about a hundred years ago, and keeping pace in point of growth and development of timber with the larch, or any of our other commonly planted Coniferæ, and in suitable situations frequently surpassing them. At Abercairney, at 160 feet elevation, in a light sandy loam upon a gravelly subsoil, it is 65 feet in height, 9 feet 11 inches at 1 foot, and 8 feet 11 inches in girth at 5 feet; and we learn that in 1860 this tree, at the same point, was only 6 feet 11 inches in girth, having thus grown 24 inches in bulk in twenty-nine years. At Hopetoun, Linlithgowshire, and at only 100 feet above sea-level, one of the original trees already referred to was planted in 1740. In 1801, taken at 5 feet above the ground, it girthed 10 feet; in 1841, 16 feet 6 inches; and in 1884, 23 feet. It was planted in good loam, on a clay and gravel subsoil, facing the north. This tree, we regret to record, after being in a dying condition, and suffering from the late spring frosty winds of several recent trying winters, has succumbed, and its giant trunk now only marks the site where its former glory and majestic boldness of outline and permanence of aspect marked it out as a noble and worthy example of those veteran cedars on Mount Lebanon, at once its glory and the boast of Palestine. Many fine cedars of Lebanon, of great magnitude, still flourish in Dalkeith Park, and seem quite vigorous, and making wood annually. They girth at 5 feet above ground, from 12 feet to 14 feet, and are growing in a medium loam soil upon clay and gravel. At Biel, in East Lothian, at an altitude of 90 feet, we find growing in a rich clay soil of a loamy character, and on a sandy and gravelly subsoil, and with its roots dipping into a stream which runs near the site, a truly majestic specimen. It is now 83 feet high, with a bole of 10 feet in length, and girthing at 1 foot, 17 feet 4 inches, and at 5 feet, 18 feet 10 inches. It is a splendid tree, with large wide-spreading and well-balanced head; while near to it stands another noble and interesting specimen of *Cedrus atlantica*, 80 feet high, and girthing 14 feet 5 inches, where it divides, at about 4 feet from the ground, into a huge cluster of twelve large limbs, which, taking an upright growth, form a tall majestic head,—a worthy rival to the cedar of Lebanon. The close proximity of these two stately and well-developed trees, of such a size, and growing under precisely the same circumstances, affords a very fitting opportunity of judging whether the *Cedrus atlantica* is really a distinct species as many arboriculturists maintain, or merely a variety. The proximity also of a very healthy *Cedrus deodara*, growing close by, enables one to compare the three varieties of cedars, and to form an opinion as to their really being distinct and well-defined species, or varieties merely of one parent cedar of a type in common, varied merely by the difference of locality, soil, altitude, and temperature, in the process of geographical distribution to which the tree has been subjected in its diffusion over the well-defined zone to which these three cedars are now known to be limited in their native habitats. To this we shall revert at a later part of this paper; meantime let us follow up the history and particulars of the Biel cedar, for it is truly a historical tree. Both it and the *Cedrus atlantica* were planted in 1707; and there can be no doubt upon that point, for a metal plate attached to them by the former Lord Belhaven, who planted the trees, and an ardent politician, certifies that they were "planted in 1707—*Traditionis Scotiæ, anno primo!*" It is to be hoped this early "*home-ruler*" lived to witness how well these memorials of his country's disgrace throve under the altered circumstances which he bewailed!

There are a number of large and very vigorous cedars of Lebanon at Dryburgh Abbey, which tradition asserts are 300 years old; while many more growing in the same park, but evidently more recently planted, are known to have been placed there by the Lord Buchan of the day, upwards of a century ago. They are all very healthy and thriving.

The immunity of the cedar of Lebanon from exposure to the sea-breeze is observable in many of our recorded examples, as, for instance, at Mount Stuart in Bute, and in the island of Arran, at Lamlash, where there is an old tree growing close to the sea, and quite healthy and hardy. The cedar of Lebanon, as will be seen from our returns, will thrive in almost any soil or site, if well drained, although it prefers a light, friable, sandy, cool loam, on an open gravelly subsoil, and luxuriates in the proximity of a running stream, into which its roots will be found to dip, and along whose banks the rootlets wander and percolate in unmistakable enjoyment.

Reverting to our consideration of the probability of the *Cedrus libani*, *C. atlantica*, and *C. deodara* being one species only, or different varieties of one species, we may remark at the outset, that the geographical distribution of these cedars is remarkable; they will be found, on reference to the map, to be confined to three separate regions in the great mountain-chains which cross the eastern hemisphere between latitude 28° and 35° north, with very little interruption from the Atlantic Ocean to the Chinese Sea. The three species (if they be species) occupy positions almost equidistant: the cedar of Lebanon being found located in the middle, with the Indian or Himalayan cedar (*Cedrus deodara*), and the cedar of Mount Atlas (*Cedrus atlantica*), occupying distinct areas, respectively east and west of it, and entirely separated from it by an interval of from 1200 to 1400 miles. Their habitats are thus restricted to a segment of a zone, the limits of which are included within 7° or 8° of latitude. From the remotest antiquity, the cedar of Lebanon and the Deodar have been associated with the religion and worship of the people inhabiting the respective regions where they are found,—probably fostered by the aged aspect and characteristics of the venerable trees, and time-worn traditions as to their origin and descent. In each of these different regions we find the trees maintaining a distinct type or appearance, quite apparent to a casual observer. But if the generic distinction of the cedars is apparently so manifest, it is by no means easy to formulate specific characters by which the three trees from the three distant regions mentioned may be clearly distinguished from each other. Sir Joseph Hooker[1] says—"That as species the three cedars cannot be distinguished, and that they must all have been derived from one common stock. It should be added that, besides the differences in habit, habitat, and colour of foliage, there are no other distinctions whatever between them,—of bark, wood, leaves, male-cones, anthers, or the structure of these, nor in their mode of germination, or duration, the girth they attain, or their hardiness. Also, they are all very variable in habit; so much so is this the case with the Deodar, which is the most distinct of all in habit, that there are several distinct varieties sold by nurserymen, some as stiff-leaved, others as dark-coloured, and others as short-leaved as the Lebanon cedar. Also, that though the differences in the shape of the seeds and scales of *C. libani* and *C. deodara* are very marked, they vary much; many forms of each overlap; and further transition between the most dissimilar may be established by intercalation of seeds and scales from *Cedrus atlantica*." Nevertheless they may be regarded as three well-marked forms, which are usually very distinct, and of which each has its own separate importance in the practical operations of planting.[2]

Such, then, being the undoubted suitability in point of hardiness, rapidity of growth, disregard of soil or situation of the cedar of Lebanon to the climate of Britain, and statistical information of its progress since introduced, as well as a list of the old and remarkable cedars in Scotland, and their soil, altitude, exposure, &c., we are led to ask the question—How comes it that a tree, in every respect so suitable for wide and extensive dissemination as an economical timber tree for this country, has not been more generally cultivated, and its economic value in Britain in modern times, otherwise than as for ornamental planting, so inconsiderable? There is no doubt that after its introduction, and contrary to the expectation of those planters who remembered only the country and not the elevated site of its native habitat, the tree proved perfectly hardy and unaffected by our climate or the severity of our winters. It was at first to a limited extent cultivated as an ornamental tree, and to the present day there are almost no country seats throughout Scotland that cannot boast of goodly specimens of this majestic tree. It is to be regretted that so few attempts (if any) have been made to grow the cedar for its timber, or to test it as a profitable tree for the planter. But on this head it must be noted that sufficient experiments have never been instituted to ascertain the highest altitude at which it will thrive best, or compete successfully with other coniferous species. Reference to our table of statistics will show at a glance that all attempts, with one or two exceptions, to grow the cedar of Lebanon in Scotland have been undertaken at comparatively low altitudes, and at such as we would rarely think of planting Scots fir or larch as a crop; and we have little doubt that, if planted *en masse* as a crop at such loftier altitudes as we introduce the larch and Scots fir to, we should find the cedar of Lebanon thrive equally well, grow as rapidly, and furnish very different results from any it has yet done in this country; for from the height at which it is found to flourish upon its native mountains, and the degree and length of cold to which it is there subjected for several months in the year, there can be little doubt but that it would prove scarcely, if any, inferior in hardihood of constitution to the larch, and might be successfully cultivated either in masses by itself or mixed with that conifer in those mountainous districts where the larch thrives with the greatest vigour and yields the finest quality of timber. There need be no fear of any slow rate of growth, which some attribute in its early years to the *Cedrus libani*. It is certainly not slower than the silver fir and others of the Abies tribe; and we have numerous instances in Scotland, where, planted under favourable circumstances, and once fairly established in a locality *at suitable elevation*, its annual growth will in many cases prove greater, while in all it will equal that of our other ordinary coniferous trees. At Rossie Priory, Perthshire, at an altitude of only about 100 feet, it was planted in 1826—at the same time as some oaks, in same situation—and the result is that now (1889) there is more wood in the cedars than in the oaks!—both descriptions being in the same soil, and equally healthy. At Bourne Park, Canterbury, cedar of Lebanon thrives exceedingly well, and has for years withstood the severity of the spring frosts, which killed the *Cedrus deodara* outright. At Highclere Castle, near Newbury, Hampshire, the oldest cedars were raised from cones collected on Mount Lebanon by Dr Pococke, and planted in 1767. The accompanying table shows the progressive increase of these trees, taken from authentic data kept at Highclere—the altitude of the site, which is given to illustrate our remarks as to the bearing of altitude upon the progress of *Cedrus libani*, being 600 feet, in a sterile soil and subsoil of plastic clay on chalk, and in an exposed situation. The measurements are taken at 3 feet above ground:—

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[1] Natural History Review, January 7, 1862.

[2] *Vide* Manual of Coniferæ, Veitch, p. 132.

									Diam. of branches.
No.	Planted.	1787.	1799.	1812.	1827.	1832.	1868.	1871.	1871.
		ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft.
1.	1767	2 11	4 11¼	6 10	8 11	9 3½	14 0	15 10	114
2.	1767	1 10⅛	3 11	6 0½	7 10	8 6	...	15 8	100
3.	1778	...	...	...	9 6	10 6	...	17 2	93

This return affords a very fair specimen of the progress made by the cedar of Lebanon at a high altitude and in very poor soil in this country, and is not an uncommon instance.

It is interesting to learn that these trees, whose progress is recorded in the foregoing table, were originally planted by the Earl of Carnarvon in 1739, from the seeds of a cone sent home by Dr Pococke, as has been stated above. They were the only two that germinated, and after being planted out, remained rather stunted, and without showing any signs of vigour. In 1767 they were transplanted into a poor soil, in a bleak situation and higher altitude, being at that time 17 inches in girth at 1 foot from the ground, and from that date their growth was improved, and considered to be satisfactory, as the measurements recorded in our table will show. These two cedars (planted in 1767), therefore, when 93 years old, measured respectively about 37 and 34 inches in diameter, and were making wood at the rate of 1 inch in diameter in about two and a half years. If this rate of growth is applied to the largest of the trees which Maundrell[1] mentions that he saw on Mount Lebanon, it would show them to be about 350, or at the most 400 years old; and it is probable that this is somewhere about the limit of age which the cedar trees attain, and not 3000 years, as has been asserted. The rapid growth of the cedar tree is borne out by a careful examination of logs imported from abroad, which exhibit a more rapid rate of growth even than we have mentioned, frequently showing that one inch of wood has been made in less than two years. We know very little of the quality of the timber of cedar trees grown in this country. Mr Peebles, at Highclere, whose experience of it, as well as of that of the *Cedrus deodara*, is reliable, and intelligently noted from his personal observation, considers it light, easily worked, open and straight in the grain, porous, and when young, or in the centre of the plank, rather soft and spongy. It is of a beautiful reddish-brown colour, and when not fully matured rather inclined to be brittle. It takes on a beautiful polish, and is of great value to the modeller and the carver, and it is admirably adapted for panelling and ornamental fittings in carpentry and cabinet work. Grown in this country, it is said to be apt to warp, and is by no means durable; but this is, however, so diametrically opposed to all the traditions of the cedar—whose wood has been generally so much associated with durability and *incorruption*—that the phrase *dignus cedro* has become equivalent to saying anything is worthy of immortality. And even at the present day the term *cedro digna* is frequently applied as a compliment. Whether, therefore, the wood of the cedar of Lebanon which has been converted in this country, has proved inferior or not, there can be no doubt that even in our own home-grown firs there is a very great difference between the wood of trees grown in proper soil suited for them, and at a sufficient altitude, and of well-ripened maturity, and that of others neglected in these respects in their culture; and it is doubtless found, as regards the cedar of Lebanon, that whatever the produce of the parks and policies of the plains of our country may be, there are good grounds for believing that, as the cedars—growing under very different circumstances of climate, in proximity to the snows of Lebanon and Taurus—yield timber of the finest quality, grown at an altitude of from 6000 to 7000 feet; so, if grown in masses, either alone or mixed with larch and fir at our higher altitudes in Scotland, in northern exposures, we shall find results arising from the introduction of this noble tree, such as have never been attained hitherto in our experience of its progress in this country.

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[1] Maundrell visited Mount Lebanon in 1696.

APPENDIX.—Cedar of Lebanon (*Cedrus libani*), April 1889.

County.	Place.	Altitude above Sea-level.	Soil.	Subsoil.	Exposure of Site.	Height of Tree.	Length of Bole.	Present Circumference of Trunk at			Diameter of Spread of Branches.	Remarks.
								1 ft.	3 ft.	5 ft.		
		ft.				ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft.	
Ross-shire	Brahan	160	Light black loam	Sandy clay	S.E.	60 0	30 0	9 1	8 3	7 10	67	80 years planted.
"	"	220	"	"	S.	65 0	10 0	12 6	11 9	11 7	72	150 years old.
"	Tarbat	15	Heavy loam	Clay	N.E	30 0	5 0	7 6	7 2	..	53	62 years old. Planted when last Earl of Cromartie came of age.
Inverness	Beaufort Castle, Beauly	100	Good loam	Gravel	S.E.	80 0	4 6	19 9	..	21 0	70	Branches off into four large limbs at about 3 ft. 6 in. from ground—hence increase of girth at 5 ft. A very symmetrical and picturesque specimen, of noble appearance. About 150 years old.
Forfar	Brechin Castle	..	Poor clay loam	Clay	..	56 0	..	14 6	..	..	66	..
"	"	..	"	"	..	60 0	..	14 0	..	..	62	..
"	"	..	"	"	..	50 0	..	13 9	..	..	60	..
"	"	..	"	"	..	55 0	..	13 0	..	..	63	..
"	Gray (Liff	120	Black loam	Sand and gravel	Sheltered	73 0	26 0	..	14 6	..	.	250 years old. 40 ft. S.W. from Gray House. Contents, 505 cubic ft. Divides into four large arms—"trees themselves!"
"	"	..	"	"	"	55 0	19 6	..	17 0	..	..	Contents, 323 cubic ft.
"	Camperdown	370	Good sandy loam	Tilly clay	S.W.	47 0	..	8 6½	..	7 7	..	Very characteristic habit. Quite vigorous.
Perth	Culross Abbey	30	Clay loam	Clay and gravel	S.	50 0	12 0	..	15 3	13 6	125	Divides at 12 ft. into two large limbs—which girth 6 ft. and 6 ft. 3 in. respectively. Growing still.

" . .	Dunkeld .	..	Good loam . .	Gravelly .	Sheltered	53 0	22 0	..	11 6	..	..	A fine tree. Growing at the Hermitage.
" . .	" . .	..	" . .	" . .	"	47 0	15 0	..	9 10	..	..	..
" . .	" .	..	" . .	" . .	"	28 0	..	3 4	..	..	..	*Cedrus atlantica.* Planted by Queen Victoria, 13th October 1865, called "The Queen's Cedar."
" . .	Ochtertyre . .	..	Heavy loam . .	Clay and sand	Sheltered	..	11 0	9 10	..	9 5	..	About 100 years planted. Very healthy.
" . .	" . .	..	" . .	" .	"	..	19 0	9 5	..	8 11	..	Do.
" . .	" . .	..	" . .	" .	"	..	14 0	9 2	..	8 4	..	Do.
" . .	" . .	..	" .	" .	"	..	18 0	9 9	..	8 8	..	Do.
" . .	Abercairney . .	160	Light sandy loam .	Gravelly . .	W.	45 0	23 0	9 5	..	8 5	..	In 1860, girthed 6 ft. 11 in. at 5 ft.
" . .	" . . .	150	" .	" . . .	"	65 0	42 0	9 11	..	8 11	..	..
" . .	Rossie Priory .	..	Good black loam .	Gravel and till .	S.	50 0	18 0	9 3½	..	8 11	..	About 100 years old. Very thriving.
" . .	" . . .	..	" .	" .	"	53 0	23 0	9 3	..	8 2	..	Do.
" . .	" . . .	..	" .	" .	"	45 0	16 0	8 7	..	8 3½	..	Do.
" . .	Moncreiffe House	50	Light loam . .	Till and freestone rock	W.	70 0	21 0	12 6	..	11 10	66	A fine specimen.
" . .	Drummond Castle	..	Light soil . .	Trap rock . .	..	49 0	12 0	..	..	7 9	..	63 years old. Very thriving.
" . .	"	..	" . .	" .	..	53 0	15 0	..	..	8 2	..	Do.
" . .	Airthrey . .	60	Medium loam .	Clay . . .	S.	54 0	9 0	8 4	..	8 0	..	Near the *Mine House*, Bridge of Allan. Lost a large limb in gale of 6th December 1881, destroying beauty of tree.
Kinross . .	Dollarfield . .	150	Light sandy loam .	Gravel . .	S.W.	60 0	25 0	7 8	..	7 1	..	..
West Lothian	Hopetoun . .	100	Good loam . .	Clay and gravel .	N.	88 0	33 0	.	..	23 0	..	In 1801, 10 ft.; in 1841, 16 ft. 6 in., taken at 5 ft. above ground. Planted in 1740.
"	" . . .	..	" . .	" .	"	63 0	24 0	..	..	14 3	..	..
Mid-Lothian .	Dalmahoy . .	170	Light gravelly loam	Clayey .	S.W.	55 0	40 0	6 11	..	6 8	.	..
" .	Hatton . . .	..	Light loam . .	Gravel and sand	S.	35 0	26 0	8 2	.	7 11		.

CEDAR OF LEBANON (*Cedrus libani*), APRIL 1889—*continued.*

COUNTY.	PLACE.	Altitude above Sea-level.	SOIL.	SUBSOIL.	Exposure of Site.	Height of Tree.	Length of Bole.	Present Circumference of Trunk at 1 ft.	3 ft.	5 ft.	Diameter of Spread of Branches.	REMARKS.
		ft.				ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft.	
Mid-Lothian .	Ratho House .	..	Light sandy loam .	Fine yellow sand	W.	68 0	6 0	12 6	..	11 7	81	A very fine specimen tree.
" .	" .	..	" .	"	"	70 0	9 0	13 9	..	12 3	85	Do.
" .	" .	..	" .	"	"	39 0	8 0	16 0	..	14 6½	83	Struck by lightning some years ago, and lost about 20 ft. of its head. Now quite healthy.
" .	Prestonhall . .	..	Good old grass land	Gravelly . .	"	60 0	28 0	21 0	..	20 2	90	Another cedar near stables here is a fine healthy tree, but devoid of branches. Very tall and uninteresting.
" .	Dalkeith Park .	..	Medium loam .	Clay and gravel	Sheltered	63 0	20 0	..	..	12 5	..	A fine specimen. In a group of eight, all very fine trees.
" .	" .	..	" .	"	..	75 0	25 0	17 9	..	14 0	..	A magnificent specimen.
" .	" .	..	" .	"	..	80 3	18 0	12 7	11 5	10 11	..	Near the stables. A noble tree.
East Lothian .	Salton Hall . .	..	Light loam . .	Limestone rock .	..	55 0	8 0	11 8	..	10 7	..	..
" .	" . . .	..	" . .	" .	..	60 0	14 0	12 5	..	11 1	..	..
" .	Biel . . .	90	Rich clay loam .	Gravel and sand	..	83 0	10 0	17 4	..	18 10	..	Planted in 1707. *Traditionis Scotiæ, anno primo.*
" .	" . . .	..	" .	"	..	80 0	3 0	14 5	..	..	..	Becomes a huge cluster of twelve tall upright trunks at 3 ft. from ground. *Cedrus atlantica* planted along with *Cedrus libani* in 1707.
" .	Whittinghame .	300	Sandy loam . .	Clay and gravel .	..	53 0	10 0	9 8	8 10	7 3	..	..

"			"	"	..	40 0	..	7 8	..	..	..	Two *Cedrus deodara* planted same time as foregoing *Cedrus libani*.
"	"	"	"	"	..	50 0	..	5 7	..	6 6	..	
Lanarkshire	Lee Castle	"	Medium loam	Sandstone & shale	..	63 0	27 0	9 3	7 11	7 2	..	Girth at 27 ft. up, 5 ft. 10 in.
"	Murdostoun	500	Sandy	Clay	..	30 0	16 0	2 11	..	2 4	..	..
Berwickshire	Dryburgh Abbey	..	Light loam	Clay and gravel	..	60 0	8 0	14 6	13 10	14 4	..	Said to be 300 years old. Five years ago was much broken down by the weight of snow during storm.
"	"	..	"	"	..	56 0	9 0	10 4	9 7	9 3	..	Twenty more in same park. Planted by Lord Buchan over 100 years ago. All very thriving.
Ayrshire	Eglinton Castle	..	Damp clayish	"	..	60 0	18 0	..	9 11	..	..	An *old* tree evidently.
"	Loudon Castle	245	Sandy loam	Clayey	S.&W.	55 0	18 0	14 11	..	14 7	..	Very healthy and vigorous.
Bute	Mount Stuart	105	Gravelly soil	Gravel	..	64 0	26 0	8 11	..	6 11	..	..
"	"	100	Sandy loam	Rock	Sheltered.	47 0	..	5 11	..	..	..	Very vigorous. Has a "cleft top."
"	"	"	"		"	50 0	..	..	6 5	6 5	..	..
"	"	"	"	"	"	52 9	..	..	4 6	4 6		Fine healthy tree. *Cedrus deodara.*
Fife	Fordell, at Inverkeithing	"	"	Gravel and sand	S.	50 0	2 0	15 0	..	12 0	80	This tree has been severely injured at various times by "wind and weather." Three years ago, four limbs were broken off by the weight of the snow. On 16th November last the entire one side of the tree was carried away by a gale, and it is now very unsightly. Six years ago it was struck by lightning, and it has been declining ever since. It was planted 190 years ago, when the family left Fordell Castle and went to reside at Otterstone, till the present house was built. It is within 40 yards of the old castle.

GENERAL SHOW OF THE HIGHLAND AND AGRICULTURAL SOCIETY, HELD AT MELROSE IN 1889.

THE Sixty-second Show of the Society took place at Melrose on 30th and 31st July, and 1st and 2d August 1889. The Society had met in the Border district on six previous occasions,—namely, at Kelso in 1832, at Berwick-on-Tweed in 1841 and 1854, at Kelso in 1863, 1872, and 1880.

The General Meeting of members was held in the Pavilion in the Showyard at 11.30 A.M. on Wednesday, and the President's Dinner took place in the George Hotel at 7.30 the same evening — Lord Polwarth presiding at the former, Patrick Stirling, Esq. of Kippendavie, at the latter.

The following remarks regarding the stock are taken from the notes of the judges:—

CATTLE.

Shorthorn.—The aged bulls numbered two only, neither of which was of very high merit. The two-year-old bulls were a good lot, the first-prize animal winning also the Tweeddale gold medal for the best bull in all the sections. This animal exhibits great size, ample flesh, with good style, quality, and constitution, altogether a very promising young bull. The second prize was neat and stylish but somewhat small; other useful animals followed. Yearling bulls were a fairly good lot; the first and second being decidedly meritorious. The first-prize cow is a model of true shorthorn shape and character. This cow was awarded the prize for best female in the three sections; two or three particularly good cows followed. Two-year-old heifers were few in number; the first-prize animal was good. The first-prize yearling was remarkably promising; nothing else in the class approached her. A small show, but the great majority of the animals well maintained the high character of the breed.

Ayrshire.—Aged bulls were a very good section. The judge had great difficulty in coming to a decision; ultimately placing them as they were at Windsor. Two-year-old bulls were rather a superior class; the first-prize one also won the special prize for the best bull in the three sections. One-year-old bulls were a small class, but the first one was a very superior animal. Cows in milk were a fair class; cows in calf were rather an extra class, the first one being a perfect specimen of an Ayrshire cow. Two-year-old heifers were a numerous class; the first and second could scarcely be beaten, the others were moderate. Yearling heifers were a very promising class.

Altogether, the Show can compare favourably with any previous one.

Aberdeen-Angus.—Taking into account the distance the Show was held from what may be termed the home of the breed, and also several outbreaks of pleuro in various counties, the breed was fairly represented in all sections. There were some exceptionally good animals, some of which had in the month previous, at the great Jubilee Show of the Royal, at Windsor, taken high places. The section for aged bulls was a small one. The first-prize bull was a bull of great style and quality, perhaps a little undersized for some tastes. The section for two-year-old bulls was a very good one, the first-prize one exceptionally so in the quarter. The section for one-year-old bulls was a very good lot all over. The aged cows were, taken all over, a very superior section: the first-prize animal was a very pretty cow, showing breeding, quality, and great feminine character. The second was also a very good cow, especially in her fore-quarters. In the section for three-year-old cows the first was a sweet animal, likely to be heard of again. The second and third, young cows of very different types, both good. The two-year-old heifers were possibly as a lot one of the sights of the Show. It was no disparagement to the first-prize heifer that the contest was keen, as all the prize-takers were good though of different types. The yearling heifers contained some very promising animals.

Galloway.—The Galloways, though not so numerous as at some of the former meetings of the Society, were in most sections of full average merit. The aged bull class was very strong, the six animals shown being all good specimens of the breed. The leading animals in the two-year-old class were also very good. In the class for yearling bulls there were only three animals shown, and the standard of merit was rather low. Cows and two-year-old heifers were very good, the leading animals in both sections being of exceptional merit. Yearling heifers were numerically the strongest class; but after the first two animals there was some difficulty in arranging the prize list, owing to the very mixed character of the lot.

Highland.—Considering that Melrose is not conveniently situated for exhibitors of the shaggy breed, the entry of Highland cattle was numerous, the quality superior, and, on the whole, would compare favourably with any of the preceding Shows. Most of the leading folds were represented. In the class for aged bulls were exhibited some of the best animals that have been shown for years. Two-year-old bulls were well represented, showing both substance and quality. The cows were a strong class, many of the exhibits being of a full average merit. In the sections for two and three-year-old heifers, the entries were numerous, most of the animals being of exceptionally high merit, well brought out, and as a class were excellent specimens of the breed.

CLYDESDALE HORSES.

Stallions and Entire Colts.—There were fifteen entries in the section for stallions foaled before 1st January 1886, ten of which came forward; they made a very good section, all the prize-winners being formerly well known in the show-ring. Lord Ailsa, the first-prize horse, moves slightly wide behind, but is in every other respect a grand specimen of a draught stallion, and was shown in great bloom. Several of the others showed signs of their travelling season, and were not in their best form. The entries of three-year-olds numbered eighteen. Although only half that number entered the ring, still they made a very good lot, the prize-winners being of very fine quality. This section was easily headed by Mr Gilmour's noted horse Prince of Albion, which was afterwards awarded the Duke of Portland's prize as best animal in male sections. He is a very gay and showy horse, with first-class feet and pasterns and good bone, and for quality he has no equal. Two-year-olds made a large section, numbering nineteen entries—all being forward except two. This section was not only the largest, but was also the most difficult to place in order of merit, as the best were of very different kinds—some possessing great quality and style, while others had more strength and substance, but wanted some other points of excellence. The section for yearlings had eighteen entries—the same number as that for three-year-olds,—and, strange to say, had also only one half forward. The prize-winners were a very promising lot, and, being well bred, will be favourably heard of again. Taken all over, the Clydesdale males at Melrose may be considered as very good indeed, and well calculated to uphold the popularity of the breed—especially when it is remembered that the Show district is not one of the horse-breeding strongholds.

Mares and Fillies.—Generally speaking, the mares and fillies were up to former years in merit, although not in numbers. In the first section—mares with foals at foot—there were a few good animals. The first prize—Chrystal (5387), a winner at former shows—was full of quality, and a grand specimen of a breeding mare. The second prize was also an animal of great merit, an excellent mover, and like one that would wear as a daughter of Prince of Wales. The others in this class were very good, useful mares. In the next section—mares in foal—the first-prize animal, Rose of Banknock by Prince of Avondale, is an extraordinarily good mare. Her legs, feet, and pasterns were all of the best; an excellent mover—in fact, you could scarcely find a fault with her but in the colour. This mare got the cup for the best female on the ground. The second mare is also an animal of much merit. The third was a mare of great substance, but wants the quality of the other two. Other mares placed were very useful animals. The three-year-olds were a grand, even class. The first prize was an uncommon filly, and was an easy first; the second was an excellent filly, a former winner at the Society's Shows; the third was a filly of great substance, not such a good mover; the fourth and fifth were also excellent fillies. Two-year-olds were a very excellent lot. The first filly was a very sweet filly; the second one had fully as much substance, and had grand fore-legs, feet, and pasterns, but had rather too much bend on the hind-legs; the third one was a very nice filly, but could be improved in the fore-feet; others in the class were good, useful animals. One-year-old fillies were the largest class of the females. The winner of the first prize was of much promise, while the second was likely to be heard of again. The other fillies placed showed much excellence, and are sure to be heard of next season.

Hunters, Roadsters, and Ponies.—The section for brood mares was a small class, and of no exceptional merit or quality. The four-year-old class of mares or geldings was a large entry, but sadly wanting in quality, soundness, and the general characteristics of a hunter. The first-prize winner in this section, although built on small lines, was the only animal of any value as a hunter in the section. The three, two, and one-year-old classes were numerously represented, but quality and soundness (more especially as to hocks) were sadly wanting: exception must be made in the case of the first and second prize winners in the three and two-year-old sections, which were all animals above the average of merit at similar competitions. In the section for hackneys, nothing of any exceptional merit came under notice. Highland ponies were above the average, and as a class were the best representatives of quality of any other class.

SHEEP.

Blackfaced. — The blackfaced sheep were quite equal in quality, although not in numbers, to those which have been exhibited in former years at the Shows of the Society. In all the sections there were animals of very exceptional merit, showing all the characteristics of this hardy breed. In some of the sections, the competition was so close that it took a good deal of discrimination to award the prizes. The extraordinary development of the shearling wethers shows that this breed of sheep is not only well adapted for going on our high and stormy mountains, but is also well suited for being fattened at an early age on our low, fertile, arable land, giving as good results as any other kind, and is laid in at a very much less prime cost. It also consumes a great deal less food than either Leicesters, half-breds, or crosses, and being hardier can be kept on higher and more exposed situations.

Cheviot.—The show of Cheviots was good, which was to be expected from the situation being in the neighbourhood of the headquarters of the breed. The judges had not so much difficulty in bringing each section down to the number for which prizes or commendations were to be given, as in afterwards fixing the relative position of each animal in the short leet. In the section for tups of any age, however, there was no question as to which deserved the first place. The first prize stood out prominently as the best sheep, and the others were worthy of the positions they held. Dinmonts were not so well represented, and some well-bred sheep of a large type had to succumb to others of a hardier kind. In each of the ewe and gimmer sections there were some very good pens, with the points showing constitution and profit well developed.

Border Leicester.—The show of Border Leicesters in point of quality was the best collection of this breed of sheep that has appeared for a number of years. Aged tups have sometimes been better, but the winners were very good specimens of the breed. Shearling tups were a grand lot, all the winners being of high merit. Ewes were not so good as have often been seen at some of our great Shows of the past, but were useful, and seemed well adapted for breeding purposes. The judging was an easy task, as mostly all the prize animals were of outstanding merit. Gimmers were a splendid class, and contained some handsome pens, which did credit to their breeders.

Shropshire.—The first-prize tup was an animal of great merit, possessing true Shropshire form and character, and without doubt the best tup of the breed exhibited. In the section for shearling tups, one exhibitor took first and second prizes with sheep of nearly equal merit. Several of the other tups in this section were wanting in strength of neck, the backs and wool being very good. The first-prize pen of ewes, though not brought out in the pink of condition, showed wonderful form and character. The second and third prize pens were fine ewes. The section for shearling ewes contained a good entry, remarkable for uniformity of type. Here again one exhibitor secured two prizes with well-matched pens. The third-prize pen had strong heads and necks, with superb wool, which would do credit to any Shropshire flock.

Short-woolled, other than Shropshire.—The entries in the different classes were very small, confined mostly to two exhibitors, who sent Oxford Down. In most of the sections, the first-prize sheep had an easy victory.

Half-bred.—Taking the half-bred sheep as a class, they were very superior and of high merit. The shearling tups quite deserve special mention, having grand style and breeding qualities.

SWINE.

The exhibition of swine showed a marked improvement on that of some recent years. In the large-breed sections both of boars and sows some very fine animals were exhibited. The Berkshire sections were good, and in the middle-breed sections some good animals were shown. They were hardly, however, what are considered the true type of middle-breed. Some showed too much of the small breed, but from age had outgrown that class, while others showed too much of the large breed to be considered altogether true to type of the sections in which they were entered. The exhibition as a whole was considered to have been decidedly good.

POULTRY.

The number of entries in the poultry class was about the same as in previous years; the general quality was above an average. The dorking sections were the best in quality, and for the early time of the year the chickens were really first class. The entries in Cochins were few. Brahmas were larger entries, and the quality fairly good. The Scotch greys were the largest entries in the show, and the different sections all contained some really good birds, even and distinct in marking. The Hamburgs were of fair average quality, but the entries only small. The game sections contained some very good birds, and were shown in nice condition. The Aylesbury ducks were very fine, and were shown in faultless condition; the same may be said of the Rouens. Turkeys were fine, and in nice condition. The geese were large, and for the time of year the goslings were very fine and promising.

DAIRY PRODUCE.

With the exception of the first four lots, the fresh butter exhibited was very inferior in quality. The first four lots, however, were exceptionally good. Powdered butter was fairly good over all. The lots marked in prize list were really fine. Cured butter generally was very poor; the most of the lots were far too salt. Cheese was exceptionally fine all over, and reflected great credit on the makers.

IMPLEMENTS.

The display of implements was much the same as usual, and it was understood that it was a very satisfactory show for the exhibitors. The implement that attracted the most notice was the Patent Strawsoniser, a distributor by air-power and a broadcast sower; but owing to some arrangement regarding the patent which had not been finally arranged, the exhibitors, Messrs Richard Hornsby & Sons, Grantham, were prohibited from showing the machine at work, which was a great disappointment to many, as the same prohibition had been in force at the Royal Show at Windsor. The competition trial was for hay and straw trusses, for which there were five competitors, showing nine machines. The judges, after a very careful trial, awarded the prize to Messrs John Turnbull & Son, Carnock, Larbert.

HIGHLAND INDUSTRIES.

The prizes offered in this department were not so well patronised as could have been desired, but a very good display was made in the entries for collections of home-made articles made from Cheviot wool, and also from blackfaced wool.

The Exhibition consisted of the following entries in the different classes:—

CATTLE.

	Bulls.	Cows.	Heifers.	Total.
Shorthorn	23	8	15	46
Ayrshire	16	16	20	52
Aberdeen-Angus	21	18	27	66
Galloway	17	7	24	48
Highland	19	9	26	54
Extra	2	3	...	5
	98	61	112	271

HORSES.

	Stallions.	Entire Colts.	Mares.	Fillies.	Geldings.	Total.
Agricultural horses	15	55	16	40	1	127
Thorough-bred	5	...	...	...	...	5
Hunters and roadsters	...	...	41	...	35	76
Ponies	4	...	10	...	5	19
Shetland ponies	8	...	7	...	1	16
	32	55	74	40	42	243

SHEEP.

	Tups.	Ewes.	Gimmers.	Lambs.	Wethers.	Total.
Blackfaced	36	18	18	18	24	114
Cheviot	40	21	18	21	18	118
Border Leicester . . .	36	12	30	...	...	78
Shropshire	22	18	24	...	...	64
Short-woolled, other than do. .	10	12	12	...	...	34
Half-bred	20	27	48	39	33	167
Extra	...	...	...	...	8	8
	164	108	150	78	83	583

SWINE.

	Boars.	Sows.	Pigs.	Total.
Large breed	6	6	9	21
Black or Berkshire breed . . .	3	9	6	18
Middle-white breed	5	6	6	17
	14	21	21	56

	Entries.
POULTRY	220
DAIRY PRODUCE—	
Butter	39
Cheese	12
IMPLEMENTS (109 stands)	1288

The following is a comparative view of the exhibition of stock, poultry, dairy produce, and implements, the premiums offered, and the receipts (gate-money and catalogues) of each of the seven Shows in the Border district:—

Place.	Year.	Cattle.	Horses.	Sheep.	Swine.	Poultry.	Dairy Produce.	Implements.	Premiums.	Receipts.
Kelso . .	1832	88	18	245	16	...	...	11	£530	£129
Berwick . .	1841	175	96	658	33	...	..	60	1050	410
Berwick . .	1854	179	141	771	86	264	...	357	1500	805
Kelso . .	1863	245	127	532	49	261	...	1101	1300	1423
Kelso . .	1872	274	214	565	56	291	...	1777	1888	2171
Kelso . .	1880	275	226	488	42	244	...	1578	2671	1664
Melrose . .	1889	271	243	583	56	220	51	1288	2276	2214

SYSTEM OF MANAGEMENT IN BREEDING STUDS OF DRAUGHT-HORSES.

By ARCHIBALD MACNEILAGE, Secretary of the Clydesdale Horse Society, Glasgow.

IN preparing this paper, schedules of inquiry were issued to leading breeders in various parts of the country, and replies have been received from the following gentlemen, to whom, as well as to all others who have assisted me, the heartiest thanks are hereby rendered:—Messrs W. H. Lumsden of Balmedie; John Marr, Cairnbrogie, and Leslie Durno, Mains of Glack, Old Meldrum, Aberdeenshire: William Robertson, Linkwood, Elgin: Andrew Ralston, Glamis; William Watson, Ochterlony Mains, Forfar; and William Allison, Clearbank, Stracathro, Forfarshire: John Gilmour of Montrave, and Edward Balfour of Balbirnie, in Fifeshire: W. Stirling Young, Keir Mains, Dunblane, Perthshire: Andrew Smith, Longniddry, East Lothian: William Renwick, Meadowfield, Corstorphine, Mid-Lothian: James A. Hunter, Machriebeg, Campbeltown: James MacQueen of Crofts, and John Houston, Overlaw, Kirkcudbright: A. B. Matthews, Newton-Stewart; William M'Connell, Glasnick, Newton-Stewart; John MacCaig, Challoch House, Leswalt; W. H. Ralston, Culmore; and Fergusson & Menzies, Cults, Castle-Kennedy, all in Wigtownshire: James Kilpatrick, Craigie Mains, Kilmarnock: William Taylor, Park Mains, and Alexander Lang, Garneyland, Paisley; Robert Wilson, Manswraes, Bridge of Weir, in Renfrewshire: Richard Dunn, Udston, Hamilton; James Weir, Sandilands, Lanark; James Park, Dechmont, Cambuslang; and William Craig, Buchley, Maryhill, all in Lanarkshire: Henry B. Howie, Hazelrigg, Belford, and Edward Charlton, Shaw House, Stocksfield-on-Tyne, Northumberland; George Rodger, Newton Bank, Warrington, Cheshire; and George Chapman, Radley, Hungerford, Berks.

As may readily be supposed, the answers received reveal considerable diversity in the details of stud management; but there is at the same time a greater amount of uniformity in general principles than possibly could have been expected. The varying nature of the climate and soil of the British Isles is well illustrated by the treatment of stock, especially during winter; and what will be most apparent as we proceed is, that the amount of rainfall in a district is a matter of considerable importance to horse-breeders. On the light friable soils of Galloway, wintering out in all weathers is the rule; whereas in the west of Scotland and in the north, that is practically unknown. If we consult the tables issued by the Meteorological Society, we will find that taking, *e.g.*, the three months of October, November, and December, 1888—in the first of these months rain fell at Braemar 23 days, and measured 3.02 inches; at Arbroath it fell 17 days, giving 1.03; at Cupar-Fife 16 days, giving 1.33; at Rothesay 22 days, giving 2.36; at Greenock 13 days, giving 3.64; at Drumlanrig, Dumfriesshire, 11 days, giving 2.50; and at Cally, on the borders of Kirkcudbright and Wigtown, 12 days, giving only 1.88 inches. In November and December of the same year the relative figures at the before-mentioned stations were—

	November.		December.	
	Days.	Inches.	Days.	Inches.
Braemar	25	6.45	18	2.95
Arbroath	24	5.16	14	2.32
Cupar-Fife	23	4.28	17	1.57
Rothesay	23	6.12	22	4.26
Greenock	20	9.05	20	7.33
Drumlanrig	20	8.10	19	4.90
Cally	21	6.72	15	5.52

The slight rainfall registered at Cupar is an interesting feature of these tables, and worthy of being kept in mind in view of what may follow.

The most important members of the breeding stud are of course the brood mares; and it will be a convenient arrangement to consider—(1) their management in studs in which they are kept solely for breeding purposes; (2) their management in studs in which they do an ordinary share of farm labour; and (3) the management of mares kept for breeding and exhibition.

In the majority of studs in Scotland there are mares of all three classes; but the most extensive breeding stud is that of Keir, founded by the late Sir William Stirling Maxwell, Bart., and now owned by Sir John M. Stirling Maxwell, Bart., and Mr Archibald Stirling of Keir and Cawder. The rich old pasture and finely wooded shelter of the Keir policies, on which this stud has so long been reared, afford opportunities and advantages in the rearing of horses not generally met with, and the mildness of the climate (the stud is within easy distance of Bridge of Allan) admits of the stock being out in all weathers. The feeding is of the lightest description, the allowance per head for each member of the stud being one bushel of oats per week, mixed with chopped oat-straw, a few Swedish turnips in the forenoon, a pailful of boiled meat—turnips, cut hay, and bran—in the afternoon, and oat-straw *ad libitum*. The great object to be aimed at in a breeding stud is to have as large a percentage of healthy foals in any one season as possible, and it is of special interest, therefore, to notice the foaling results in the Keir stud during a number of years. In the following columns are given the number of mares served during the last three seasons, and the relative foaling results in the succeeding season:—

YEAR.	SERVED.	RESULTS.
1887 . .	28 mares	20 foals.
1888 . .	29 "	19 "
1889 . .	32 "	18 " (probable).

Of course it is to be understood that the method of feeding here specified is not absolute, the condition and nature of each animal having to be considered; but the main features of the feeding as followed at Keir have been indicated.

The Balmedie stud is not an old-established institution, but its representatives have taken good positions in the leading showyards. Generally about half-a-dozen brood mares are kept under our first class, and during winter they run at grass all day, but are housed at night. They are fed thrice daily—at 5 A.M. and 4 P.M. with boiled mash, and at 8 P.M. with hard feeding, consisting of about 1 lb. oats to each, mixed with one turnip, and enough cut hay to fill a pail of the capacity of two gallons, with an abundance of fresh oat-straw for fodder.

In the Cairnbrogie stud there are seven mares kept solely for breeding purposes. These run at grass all the year round, but are housed at night during winter. They get hay and a few turnips uncooked when taken into the house at night—say about 20 lb. long hay, and 12 lb. Swedish or yellow turnips each in open weather, and a somewhat larger allowance if the ground is covered with snow. Mares of a similar class are treated somewhat more liberally in the Linkwood stud. The weather conditions in Morayshire are almost similar to those in Aberdeenshire, and housing in winter is the rule. They run out all day, and their allowance, besides grass, is hay or oat-straw, with bran and one half-feed oats and some turnips each per day before foaling; but, about a week after foaling, the quantities are increased, in order that there may be an abundant supply of milk for the foal. This is continued until the young grass is up, when it is discontinued, and the mares then get nothing but what they pick up. If possible, the aftermath is reserved specially for mares that are nursing.

In the stud at Huntlyhill, owned by Mr Morton P. Campbell, yr. of Stracathro, there are three mares kept solely for breeding purposes, and their treatment is in the main similar to that already specified. They are housed at night from the end of October until after foaling, and their rations per head during that period are—one feed of oats in the morning, and a feed of boiled barley and beans at night, in addition to what they pick up in the field during the day.

Turning to Fifeshire, the most notable feature is the large stud of mares kept by Mr Gilmour at Montrave, 550 feet above sea-level, and comprising some of the best known prize mares of recent years. The brood mares number fifteen, and of these seven come under our present classification. Generally the winter at Montrave is somewhat protracted, and there are frequently heavy snowstorms; nevertheless, the mares remain out all the year round, but have sheds into which they can betake themselves if so minded. The general experience however, is, that even in the worst weather they prefer to lie out rather than inside the sheds. It is an evidence of the hardiness of the native breed of horses, that in spite of their apparently hard lot, the mortality amongst the animals composing the Montrave stud is perhaps the lowest in Scotland, and the foaling results are, as a rule, as successful as could be desired. During winter the mares are fed twice daily with bruised oats and chopped hay, and a few raw Swedish turnips. The daily proportions are about 14 lb. of the combined food per head, one half being given in the morning and the other in the evening, during the period from the end of September until the grass comes in spring.

The county of Wigtown has for many years occupied a leading place as a breeding district for Clydesdales, and the management of brood stock there will be of considerable interest. Through the kindness of the gentlemen named in the introductory remarks, I am able to give particulars somewhat full and detailed, and first of all refer to the stud owned by Mr A. B. Matthews, Newton-Stewart.

Seven mares in his stud at Carsegown are usually reserved for breeding purposes, and in summer they receive nothing beyond the grass where they are pastured, unless something additional be given to hasten the growth of any foal they may be nursing. The usual system during winter is to graze them on a timothy meadow which has been cut for hay about midsummer, and the after-growth allowed to spring up until it is nearly as long as the first cut. This is then grazed until about half eaten down, after which it is devoted to the brood mares, which are turned out on it about the beginning of winter. By this means they have always a good bite of natural grass, even when the ground is covered with snow, and in addition they receive as much timothy hay twice a-day as they care to eat, and about 6 lb. of crushed oats and 1½ lb. bruised linseed-cake each per day. Rock-salt is kept in front of all animals in this stud, a course that should be universally followed. The soil of the meadow is mossy and dry, and its situation affords shelter from north, east, and west winds. There is a shed open at all times, in which the animals are fed, and where they can take shelter if they feel inclined. Two results of great importance to stock-breeders have been observed to follow from this treatment: first, mares in foal come to the foaling in the following spring particularly strong and healthy, and their foals are more vigorous and healthy than are those of mares otherwise wintered; and second, mares that have proved barren in the previous season, after being so wintered settle much more easily to the horse.

In Mr M'Connell's stud, the treatment of this class of mares is practically the same. They are never housed except for a few days after foaling. From November to April they are fed with 4 lb. oats, 1 lb. bran, and about 8 lb. cut hay per head in the morning, and should there be snow on the ground the quantity of cut hay is repeated in the afternoon. In regard to the foaling of mares, Mr M'Connell remarks: "I approve of the mares being foaled in the loose-box, and remaining in for a week during April and May. I have lost mares that foaled out, as they are apt to catch a chill."

Mr MacCaig has been a most successful rearer of foals, and his mode of treating brood mares merits special notice. Five mares are reserved solely for breeding purposes, and they receive about half a feed of oats mixed with double the quantity of cut hay every morning, and there is always an abundance of long fodder in their mangers. At night they get a quantity of raw turnips, but when they come near foaling this is altered to a nice light sloppy mash. There are loose-boxes in the fields in this stud, and three of the boxes are so arranged that the mares can go in and out at pleasure, when they have grass and water *ad lib.* A bar is put across the door of each box at night, because it is found that even on the roughest nights mares incline to lie out, and there is considerable risk that in doing so the foal may contract rheumatism or other ailments. This uniform treatment of the mares outside is found preferable to keeping them inside during winter, and turning them out four or five hours daily, because in the former case the animals are kept at a more uniform temperature, and are therefore less liable to chills.

From the replies received from other gentlemen in the Rhins of Galloway, there would appear to be some diversity of treatment in regard to the wintering of brood mares—some keeping them out with the optional shelter of a shed, and others following the course indicated as adopted by Mr MacCaig. But all admit the mildness of the climate; and as we shall see later, in the case of young stock, wintering out is altogether the rule. In Lanarkshire, housing at night in winter appears to be the general rule, and the feeding, as compared with that already specified, is somewhat heavy.

Mr Dunn feeds three times daily,—at 5 A.M., mash, composed of the usual ingredients; 12 noon, cut corn-sheaves; and at 6 P.M., a mash, as in the morning. When about a month from foaling, the mares are fed with cut straw and bran damped with treacle water, and a handful of Epsom salts is given twice weekly.

In Mr Howie's well-known stud at Hazlerigg, the mares under the present class during winter get about eight pounds bruised oats each per day, with straw and a few raw Swedish turnips. They are turned out to graze during the day, and at night are housed in a fold or court—three or four of them going together. Mares that are to be treated a little better may get a little boiled corn and treacle. Sometimes yeld mares are grazed with fillies in a field of old pasture where there is a shed, and these get only one feed—crushed oats and turnips, with a supply of oat-straw or hay should there be plenty of it.

Mr Rodger's stud consists of five or six mares, all practically kept for breeding purposes only. They run at grass day and night during summer, and get no extra feed but what they pick. In winter they are turned out during the day to grass, and are housed in loose-boxes at night. The hand-feeding, of course, varies according to the condition of the grass; but in the middle of winter it consists of four feeds daily. The first is given at 6.30 A.M., and consists of the ordinary mash; the second is at 9 A.M., consisting of crushed oats and chopped hay, and this is repeated at 5 P.M. when the mares are brought in. At 8 P.M. the fourth feed is given, and is practically a repetition of the morning mash. Mr Rodger regards it as of the utmost importance that mares should foal early in the year; and the above hand-feeding is continued for about four months after foaling, until grass becomes more plentiful.

Mares of the class now under review are apt to be somewhat neglected by breeders in respect to the care of their feet and legs, because, not being required either for work or showing, they are little taken notice of, except when in season and about the time of foaling. But there can be no greater mistake than this, because it is an accepted truth in breeding that acquired defects in course of time become constitutional and consequently hereditary; and while there is no occasion to have these mares shod, their feet should have careful attention and be dressed at regular intervals, care being taken to prevent the hoof breaking. The toes should be kept short, and the hoof of a round open shape, and the pressure brought to bear on the frog and heel. In this way the hoof-head is kept open and round and the heel wide—two of the most important characteristics of a sound foot.

The second class of mares—those kept both for work and breeding — is, it may well be supposed, in Scotland much more numerous than the last under notice, and considerable diversity prevails in the treatment of these mares. On one point there is, however, absolute unanimity amongst breeders—viz., that mares in foal should be carefully worked in cart-yoke at all times, should not be "backed," and for two or three months before foaling should only be wrought in plough, and more and more leisurely and carefully as the foaling-time draws near. At the same time, there is equally general agreement amongst breeders that mares thus carefully handled have usually the easiest foaling-time, and the strongest, most thriving, and healthiest foals. All this is perfectly intelligible, and in accordance with nature. The natural state of the draught-horse is that of labour; and while the class of mares first considered cannot be said to lead an unnatural existence, there can be little doubt that the third class—mares for exhibition—undoubtedly do so.

In the Linkwood stud the ordinary rations for work-mares in foal are 168 lb. bruised oats to the pair per week, with a small allowance of Swedish turnips, and hay *ad libitum*. A small proportion of Epsom salts, about 2 oz. each, is given occasionally on a Saturday night; and in Aberdeenshire it is customary, about a month before foaling, to give more laxative food, such as bran and linseed, than at an earlier date. The Earl of Strathmore has a stud of fourteen breeding mares, all of which are wrought at ordinary farm labour, and treated up to the time of foaling as already indicated. After foaling, and while nursing, they are hand-fed at first with mashes and soft food, and later on, as harvest approaches, with oats. I do not think it is general to hand-feed mares while nursing; but the course followed in Mr Morton Campbell's stud of giving such mares a feed of oats night and morning if in low condition is probably not exceptional. If the mare foals early and the grass is scarce, Mr Gilmour prefers feeding with bruised oats and chopped hay and a small allowance of Swedish turnips; while Mr Bisset, the able farm manager at Balbirnie, is strongly in favour of a bite of good grass as the most favourable food for mares immediately before and also after foaling. Mr Lumsden remarks in this connection that some mares are at best but poor nurses, and the food of the mare may be made so as to greatly influence her yield of milk. Mares that foal early and have little nourishment for their offspring, are generally fed on sloppy food, consisting of boiled barley, oats, turnips, and cut hay, mixed with some meal. Bean is considered to be specially valuable for this purpose, and can never be dispensed with. The quantity recommended for one meal by Mr Lumsden is as follows: 1 lb. oats, ½ lb. barley, 1 lb. bran, 1 lb. bruised oats, and 1 lb. cut hay and straw, with a few turnips, and a little salt and treacle, three times a-day.

There are, however, mares whose milk is alike plentiful and strong, causing diarrhœa in the young foal. This is an evil to be guarded against, and it is found useful in such a case to put the mare on dry food and straw fodder; and if at grass, she is put on to the oldest, where it is least succulent, and sometimes it may be advisable to drain off some of the milk by hand. These cases are, however, comparatively rare, and exceptional treatment of this kind is therefore not much called for.

These particulars give a good general description of the treatment of mares of this class all round; but there are some phases of the question which have not been touched on, and no apology is needed for a somewhat detailed account of the management of a Kirkcudbright stud, which has an enviable record for its success in rearing foals. Mr Houston, Overlaw, has a stud of seven breeding mares, all of which do their full share of farm work, and are not exempted from labour for an hour until they come to the foaling. For feeding during pregnancy they get bruised oats and linseed-cake, with Swedish turnips and fodder in abundance. A *little* boiled food, seasoned with "horse powder," is given to each mare twice a-week. Mares, while nursing, are not hand-fed, but after a mare has again been stinted, she may get a proportion of bruised oats and linseed-cake, both for her own sake and the foal she is nursing, as well as to strengthen the future offspring. One remarkable feature in the mares in this stud is, that they are not infrequently spoken of as being too fat; and in spring when the foaling season is coming near, breeders of experience have often had misgivings as to the foaling results amongst the Overlaw mares. The issue, however, has invariably belied these gloomy forebodings, as there is probably no collection of mares of a similar class in Scotland that have bred so regularly, and with so small a percentage of deaths. In the six years 1885-90 inclusive, thirty-four mares have been served by the horse, and of these twenty-nine have proved in foal. Seven of these have yet to foal; but of the twenty-two that did foal, twenty have produced foals that lived to be weaned. The only deaths have been a filly foal in 1887, and twin fillies that lived to be six weeks old in 1888. It does not come within the scope of this paper to detail the later doings of the foals that were reared so successfully; but it may be mentioned generally, that of the twenty that were weaned most are now alive, and all of them came to be at least two years old, while several have been prominent prize-winners.

The lesson to be learned from the results in this stud would seem to be that, given steady cautious work and careful handling, breeding mares are all the better to be liberally fed. A state of body verging on that produced by "high" feeding is rather beneficial to the breeding mare than otherwise, when her whole frame is in a state of training from regular work.

Mr Houston's views and experience are generally corroborated by Mr Matthews and Mr Ralston; but Mr MacCaig approves of mares being exempted from labour for about three or four weeks before foaling, and allowed to be acclimatised, as it were, to the grass by the date of foaling. Others have found hard work and hard feeding detrimental to foaling results; or, to put it otherwise, they have wrought their mares somewhat hard, and fed them rather high, and have not been fortunate in getting many foals. This is an experience very common in the vicinity of large towns; and it is an accepted truism amongst stallion owners that no horse can leave as large a percentage of foals, in the district round Glasgow, for example, as in Galloway. Two of the most experienced breeders in the former locality express the opinion that mares should not be allowed to foal outside earlier than the middle of June; and for feeding, Mr James Park recommends pulped turnips, cut corn-sheaf, cut hay, with a little Indian corn and oats, and a liberal supply of rye-grass hay. On this—given in due proportions twice a-day in open weather, and thrice when there is snow—mares that are idle are found to thrive admirably.

In a stud of sixteen mares owned by Mr Chapman in Berkshire, all of them that are in foal are regularly wrought until within a fortnight of the foaling date; but for a month previous to that they get the lightest part of the work, and are never allowed to be put between shafts from the moment they are seen to be with foal. After foaling they are fed with chaff, bran, and a few oats, until the foals are strong enough to lie out. The reason of this, of course, is, that the foaling season is much earlier in England than in Scotland; and hence, no doubt, in some measure, the earlier maturity of English-bred horses. An intelligent American, who buys largely, has expressed the opinion that, while the yearlings and two-year-olds in England are bigger and heavier than horses of the same age are in Scotland, the difference is almost entirely removed amongst three-year-olds and aged horses, and there can be no doubt that Scotch horses in general grow at least until they are six years old.

The feeding of an ordinary farm mare during the period of hardest work in winter and spring is worthy of attention. On many farms in Glasgow district, where there is much heavy carting, the allowance per week for each horse is 3 bushels bruised oats, Indian corn, and cut hay—say in the proportion of 2 bushels oats and 1 bushel Indian corn—with cut hay added, a pailful of boiling to each animal nightly, consisting of barley, turnips, and chaff, mixed in a large cooler, with one basketful of bran, and as much good rye-grass or timothy hay as each horse can eat. The use of boiled food is dying out in the west of Scotland, and on many farms it is never used. Horses winter much better, and are less liable to colic, without it. In Ayrshire, in districts where early potatoes are raised, and high farming generally is the rule, the morning feed for each work-horse at 5.30 is 3½ lb. bruised oats, 3½ lb. Indian corn, and 3 lb. chopped hay, mixed. At noon a repetition of the same. At 6.30 P.M. 3½ lb. bean-meal and 3½ lb. chopped hay, mixed together and saturated with boiling water, five hours before feeding-time. At all times, in addition, the horses have an abundance of good hay in front of them.

Mr David Walker, Coullie, Udny, gives the following as good rations for a work-horse: Feed six times a-day. 5 A.M., mash, consisting of 2½ lb. oats and 3½ lb. bran; 5.45 A.M., 2 lb. oats; 11 A.M., 2½ lb. oats; 12 noon, 2½ lb. oats; 6 P.M., 2½ lb. oats and 3½ lb. bran in mash; 8 P.M., 8 lb. raw turnips. Hay uncut *ad lib.*, and oats always bruised.

Work-horses should be fed at least four times a-day, and from 14 to 16 lb. of grain, with as much fodder as they can use, is a good allowance for each animal.

In dealing with mares kept for showing, breeders are fairly unanimous in inclining to the belief that the dual work of breeding and exhibition can rarely be carried on successfully. Many of those consulted condemn the practice of showing breeding mares, and Mr Rodger makes the suggestive remark, that he never shows brood mares unless they get themselves into condition by the use of the ordinary feeding of all the stock in the stud. Mares may be exhibited locally with very little extra feeding and attention. In such cases they are exempted from labour perhaps a month before the date of the show, and turned out to graze in good pasture. Sometimes nothing more than this is required, but should they have been in low condition when taken from work, they may also get a feed of oats and a proportion of linseed-cake daily. The risks attending the feeding of mares for the larger exhibitions are many and aggravated. Should the mare have been long fed for showing purposes, there is little prospect of getting her in foal at all, without taking the flesh off her, and abandoning all notion of prize-winning. But should she by any chance be got in foal while in high condition, the risks of inflammatory founder at foaling are great; and even if these be escaped, the probability is that the foal will be undersized and weakly.

A good plan to follow in the case of a mare intended to be shown, say, in the mare-in-foal class at the Highland and Agricultural Society's Show in July, is to have her in ordinary healthy condition during the preceding winter, and have her served on the earliest opportunity in spring. If got in foal then, she will on ordinary feeding soon begin to thrive, and a little additional food may then safely be given to her. It is, however, pretty certain that a mare cannot be hurried for exhibition; the work must be done gradually, and great care must be taken that a mare, in the case supposed, be not unduly excited, as there is much risk of the fœtus being slipped at the tenth or eleventh week. The best of all methods of bringing out mares for shows is first of all to have mares that are naturally perfect in all essential points—with feet, pasterns, and legs of the right sort; short, level backs; well-sprung ribs, good quarters, and well-developed thighs. A mare of this class when lean, if wintered out, can be shown anywhere and at any time; but a mare that is naturally flat in the rib, and plain behind the shoulder, will take an immense amount of feeding to get her into shape for the show-ring.

Turning to the facts as we find them, it appears from the answers received that show mares in Galloway and Fifeshire are invariably wintered out, a shed being erected in each field in which they can take shelter on an exceptionally stormy night. In Lanarkshire the practice varies, and in Aberdeen and Moray they are invariably housed at night during winter. The latter course has also to be followed in the higher districts of Galloway, where they are kept in loose-boxes at night and turned out during the day. Mr MacQueen recommends for feeding, bruised oats and cut hay, meal at night either boiled or wet and well mixed with bran and linseed, and sometimes treacle. Highly fed mares graze best along with fillies and cattle, and in the Montrave, Balbirnie, and Carsegown studs, show mares are seldom, if ever, in loose-boxes. When treated in this fashion, they are not only sounder and in a better general state of health, but their legs, feet, and feather have in every way a superior appearance. Mr Matthews estimates that a full-grown mare, when being prepared for show purposes, requires from about 16 to 20 lb. of food per day, consisting of the ingredients mentioned by Mr MacQueen.

Mr Dunn's method of treating mares in course of preparation for showing, is fairly representative of the course generally pursued in the west of Scotland, although some do not keep them out at night in winter. He keeps the mare by herself in a small paddock, well fenced and watered, and having a loose-box in it, open at all times, in which the animal is fed. The feeding consists of five meals per day,—at 5 A.M., boiling, consisting of cut straw, bran, turnips, beans, treacle, and about a glass of linseed-oil; 10 A.M., cut oat-sheaf mixed with bruised oats; 1 P.M., drinks, consisting of pease-meal, oilcake-meal, treacle, and bran; 5 P.M., same as at 5 A.M.; and 8 P.M., same as at 10 A.M. These successive feeds are not given in large quantities, as it is found better to feed oftener in small quantities than less frequently in large quantities. In regulating quantities, much of course depends on the state of the weather and the condition of pasture; and an experienced breeder in the Glasgow district is of opinion that in a fairly mild winter, a mare that is running out, and intended to be shown in the following season, can be kept in good condition on about 18 lb. per day of bruised oats and Indian corn mixed with chopped hay. The Montrave show mares receive no more feeding than the others, —viz., about 14 lb. daily of bruised oats, chopped hay, and a proportion of raw Swedish turnips, given twice daily, half in the morning and half in the evening. In the Balbirnie stud, two mares in course of preparation for showing, have the run of a nicely sheltered park of about 20 acres, with a shed in a corner. In the morning their food is bruised oats; at mid-day the same, with a few knots of good linseed-cake added; at night, a small pailful of boiling, composed of Swedish turnips, chop of bean-sheaves, and hay and cut straw mixed. These ingredients are all boiled together, and when well mixed with a little bran in a cooler, form the staple food, in varying quantities, for stallions, mares, and fillies, of all ages. Some good hay in addition is given at each diet.

The winter treatment of show mares given by Mr Marr is as follows: They run out during the day with other stock, and at night are housed in separate loose-boxes, when they get hay *ad lib.*, a few turnips, and, say, 4 lb. bruised oats, 4 lb. bran, and 2 lb. linseed-cake or thereby each. In summer they are grazed by themselves, and not housed at night. Their diet then is 3 lb. oats, an equal weight of bran, and 1½ lb. linseed-cake each, given to them in the fields. Should the pasture be good, however, they get nothing but what they pick up.

Lying out at night in stormy weather is not at all good for highly fed mares, as they are ready to catch colds, which may result in more serious disorders. In winter and early spring the Balmedie show mares are out all day and housed at night. They are fed twice daily on boiled food, and twice on dry corn. The diets are as follows: 5 A.M., boiled meat, consisting of 1 lb. corn, ½ lb. barley, 1 lb. bran, ½ lb. bruised oats, and 1 lb. cut hay or straw, mixed with a few turnips and a little salt and treacle; 9 A.M., dry corn, consisting of what is ordinarily termed chop (the proportions are 2 lb. corn, ¼ lb. bran, ¼ lb. bruised oats, 1 lb. cut hay and straw, with 2 lb. hay, placed in rack night and morning); 4 P.M., same as at 5 A.M.; 8 P.M., same as at 9 A.M. It is a mistake in using cooked food only to have it boiled on every second day, as on the second day the food has an unpleasant smell, and horses are extremely sensitive to anything of this kind. A mare should never receive more than she can eat, and the quantity should at once be reduced if it is found that some is left over. The feeding-trough should be carefully cleaned out before fresh food is put into it, and the groom should study the tastes of every individual mare, as all will not thrive alike on the same feeding.

Mr Durno gives some interesting figures regarding the feeding of mares, which are both wrought during winter, and shown at local and county gatherings in summer. They are taken from work about May and put into loose-boxes. Their food consists chiefly of oats, bran, linseed-cake or locust-beans, and plenty of hay or grass, in daily quantities to each animal of about 9 lb. oats, 2 lb. bran, and 2 lb. of either linseed-cake or locust-beans. The course pursued by Mr Robertson is somewhat similar, care being taken that the mares get plenty of exercise, and that their feet and legs are in fresh healthy condition.

On the general management of the feet and legs little need be said. Constant exercise, and care to have the feet kept level, low at the heels, and short in front, will generally do all that is required, and I have not thought it necessary to collect information regarding the various plans adopted for "doctoring" the feet and legs of animals constitutionally defective in these parts. One trouble that has to be guarded against, especially in highly fed animals, is the heating of the legs and "itch" caused thereby. The late Mr Drew's solution for this trouble was as follows: One gallon of pure train-oil, and one bottle of spirits of tar, mixed with a few handfuls of sulphur until the whole is brought to the consistency of cream. This is an eminently safe specific, and much more to be recommended than the following, which also has advocates,—viz., a weak solution of common paraffin-oil, say two parts paraffin to one part water —or M'Dougall's non-poisonous sheep-dip. Before the application of either of these remedies, the parts affected should be well washed with soap and water.

After a mare has foaled, she should be sheeted for a couple of days to prevent chills, and the sheets should be gradually removed as the normal state of the body is resumed. Great care should be taken in the choice of a day for turning the mare and foal out for the first time. The day should be dry, and the grass free from white frost, which is frequently common in the west of Scotland, as late as April and May. For the first eight days, should rain begin to fall, the mare should be at once sheltered, as the foal, if exposed in such weather, may contract joint-ill and other diseases, and the mare herself has a tendency to colic. These conditions are carefully observed by the most successful foal-rearers in the Glasgow district, and they also strongly recommend that a foal at any time should never be turned out to graze while there is hoar-frost until after it has had a meal in the house.

After the foal has been weaned, the condition of the mare requires some attention. In order to put her dry, 4 drams of aloes, along with a pint of linseed-oil, has been found beneficial, and the food rations should be reduced in quantity, while they are made as dry as possible. When the udder becomes full so as to cause uneasiness, a part of the milk should be drawn off, but the udder should not be emptied. Bathing the udder occasionally with vinegar assists greatly in the process of drying off.

Turning now to the younger members of the ordinary stud, the treatment of foals first demands our attention. The age at which they are weaned varies somewhat, but there is a general opinion in favour of from four to six months old. In Aberdeenshire and Morayshire the average age quoted is five months, and in Forfarshire two breeders say four months, and one four and a half months. The Montrave foals are uniformly weaned either in the last week of October or first week in November. In East Lothian four months old is the usual age; but in Kintyre the mares nurse for about six months, unless they should be required for work earlier. Mr MacQueen quotes the second week in October as the usual date for weaning in the higher districts of Galloway; and other breeders in the south indicate that the foal, as a rule, would be best weaned when about five months old; but in the race for prizes it has become customary for the mares to nurse them much longer—one experienced breeder of prize animals quoting the weaning time as at six or seven months old. This practice is, however, generally condemned in the west of Scotland; both Mr James Park and Mr William Craig specifying from sixteen to eighteen weeks as quite long enough for any mare to nurse a foal, and the former gives as a reason for this that foals nursed for a longer period acquire the appearance of a "fed veal." Mr Chapman weans his foals in the beginning of October, a date likely to be pretty general in England.

Should a mare be a poor milker, there is nothing better for either her or the foal than a feed of oats twice a-day; but in the case of a mare constitutionally defective in this respect, the foal is much better to be taken from her when about three months old. It will thrive much better on good food than on the milk of its dam—in all likelihood deficient both in quantity and quality.

The time of the separation of dam and foal is a crucial one in the life of the latter, and much depends on the wisdom with which the separation is carried out, and the treatment the youngster receives after weaning. The plan found most advantageous is to hand-feed the mare for about a fortnight before the foal is taken away. During this time the foal learns to eat the bruised oats and "chop" served to its dam, and consequently when deprived of the latter's milk it is not so much disturbed. The objection to this method is that the foal invariably goes back in condition for a time, and some breeders, for about a fortnight before weaning, graze the mare and foal in a field of young grass—a "seeds" field as it is sometimes termed—in which it is intended that the foal should be wintered, and quietly lead the mare out when the time of separation has arrived. This, however, necessitates good fencing, as the foal is ready to follow the mare if at all possible. The more usual method is to shut the foal in a loose-box for a week or ten days after weaning, when it is fed in some cases on a mixture of cut hay, oats, and bran, with a small proportion of treacle. After a time it is allowed to run at pasture, as detailed below.

In Aberdeenshire, as is the case with all stock, foals, in winter generally, are housed at night and run out during the day; but in the Balmedie stud they are wintered altogether outside, but have a shed to take shelter in if they choose. Having been taught to eat a little along with their dams before separation takes place, for the first few days after that event foals are fed with a little porridge, mixed with bran and sweetened with treacle, given in the form of a gruel-drink. The diets are small, but of frequent occurrence, and the gruel is always fresh. Afterwards they receive a little bruised oats, mixed with bran and cut hay, and damped with treacle and water, and a moderate allowance of good hay. As soon as possible they are turned out to graze, when they are fed four times daily—viz., at the same hours as the mares, 5 A.M., 9 A.M., 4 P.M., and 8 P.M. At 5 and 4 they get boiled food, and at 9 and 8 corn, with a fair allowance of good hay. As regards quantity, Mr Lumsden reckons three foals equal to two mares. When two or more foals are wintered together, they are fed separately—*i.e.*, they are tied up when feeding, or otherwise prevented from plundering one another's food.

Older fillies are wintered in the same way, with a slight increase in the quantities of food given; but except in the case of fillies that are to be knocked about from show to show, hand-feeding in summer is dispensed with at Balmedie.

In other studs in Aberdeenshire, foals in the morning get a feed of oats and bran mixed in equal proportions, and in some cases the same is repeated when they are brought in at night; but in others the evening meal consists of a boiled mash composed of oats, barley, beans, and turnips, with plenty of hay or oat-straw.

During winter the foals in the Linkwood stud are run out from 8 A.M. until dusk, and fed with mashes of bran and bruised oats, and plenty of good hay. Mr Robertson does not believe in feeding with a great deal of boiled food. He used to do so, but finds the young stock much healthier when fed as already described, being careful, however, that no bran or oats be given without being well mixed with cut hay or oat-straw of good quality. The fillies do not "bolt" the food too quickly when thus mixed, and a pound or two of linseed-cake is found suitable for all classes of stock.

In the Glamis stud, the foals, on being weaned, are fed on the mixture of oats, cut hay, bran, and treacle steeped, already specified. As the autumn advances this gives place to rough-boiling, composed principally of hay or oat-straw, turnips, bran, treacle, and a little barley, which is served to them night and morning, the older fillies receiving, in addition, about 10 lb. bruised oats per day with hay. Mr Ralston remarks that it has been proved to be of great importance that the young stock, especially foals and yearlings, should be given their food in a rough open state, and free from all richness. This natural feeding keeps them right on their legs, and at the same time in a thriving healthy state.

Foals in the Montrave and Balbirnie studs, like fillies of maturer age and mares, are wintered out, and in the former stud receive about 10 lb. each daily of the dry chop on which the older animals are fed. Mr Bisset feeds with rough-boiling twice a-day, similar to that used in the Glamis stud, and oats bruised and mixed with bran once a-day. If, however, diarrhœa ensues, boiling is only given once a-day, and oats are given in place of the second boiling. In preparing fillies for showing, next in importance to good natural shapes Mr Bisset considers wintering out and rough open feeding, with bruised oats and plenty of good hay. The sheds in both of these Fifeshire studs are models of what such erections should be, with feeding-boxes and hay-racks in each; and although the climate is severe in some respects, it cannot be said to be damp, and, after all, it is the latter that determines the mode of wintering that may be most successfully followed.

In East Lothian, foals and young stock generally are wintered out; and in the Longniddry stud, until the grass comes in May, they get two feeds of bruised oats, with cut hay and some bran, daily. In Kintyre, on the other hand, Mr Hunter reports that young stock are housed at night during winter, and foals receive hand-feeding as follows: 6 A.M., mash, consisting of boiled turnips and chaff, mixed with a little ground barley; 9 A.M., oats; 4 P.M., mash as in morning; 8 P.M., oats, with a few raw carrots amongst them.

Foals and fillies, especially if intended for showing, are more liberally fed in Galloway than elsewhere, and wintering out is, except on the higher grounds already named, the absolute rule. After weaning, the youngsters are generally put on to a field of young grass, where they remain until the following spring. Their feeding, in one stud, consists in the morning of bruised oats and bran or linseed-cake; at mid-day, dry chaffed hay and bruised oats; and in the evening, boiled oats, turnips, and a good proportion of chaffed hay.

In the Kirkpatrick-Durham district, which stands 600 feet above sea-level, it is impossible to winter out; and Mr MacQueen remarks that a good deal depends on the elevation, the locality, and the situation of a farm, whether the breeding and rearing of young stock can be carried on successfully. The higher and poorer the land, more hand-feeding is required at any rate to bring out horses for showing. However, not much difficulty in this direction is met with in Wigtownshire and the lower levels of the Stewartry, which may safely be termed the land of Goshen for young Clydesdales. The only problem breeders and exhibitors in these localities have to solve, is how to prevent foals going back in condition immediately after weaning, and various devices have been resorted to to obviate this. One of them has already been commented on—that of nursing the foals until they are seven or eight months old; another, that has not much to recommend it, is to give the youngsters a liberal supply of cow's milk. By this means it is possible to have splendid big yearlings, with lots of feather, &c., and big stomachs; but no better means of manufacturing wind-suckers was ever devised, and it is rare that yearlings so brought out count for much as two-year-olds and three-year-olds. The most rational process is to put the foals on to a field of good rich pasture—young grass preferred, if it does not cause diarrhœa; care being taken, however, that the new pasturage is not too rich, as compared with that on which they had been running. with their dams. To transfer foals from bare pasture to rich young grass is about as sure a way to kill them as any that could be named. Boxing foals after weaning is sure to cause a fall in their condition ; and half the winter may be over before they recover what they have lost. On the whole, therefore, if it can be managed, the most popular way of treating foals in Galloway is to wean them in the grass-field in which it is intended to winter them, and feed them during winter twice a-day on a proportion of bruised oats and linseed-cake; say something less than 12 lb. each per day for foals, and from 12 lb. to 14 lb. each per day for fillies rising two years old and three years old. Fillies wintered inside, other things being equal, have little chance in the showyard against those wintered in this fashion.

The following proportions are given by Mr MacConnell as a daily allowance for a foal wintered out—viz., 2 lb. oats, ½ lb. maize, ½ lb. peas, with ½ lb. bran—all bruised and mixed with cut hay. If grass be scarce, the same proportions will be observed, boiled beans being substituted for peas. Mr W. H. Ralston says foals are fed twice a-day with 7 or 8 lb. of mixture—composed of one part cut hay, one part bran, and two parts bruised oats; the same composition, but in larger quantities, with as many raw turnips as they will eat, being given to the older fillies.

The climate in the Rhins of Galloway during most winters is extremely mild, and there is generally a freshness of grass during the whole season. The soil is also very porous, and the youngsters have always, notwithstanding the moisture of the climate, a dry bed, and hence rheumatism is almost unknown. When run out they can be fed more safely, and do much better on grass during the following summer than when wintered inside; while the advantages in keeping the feet and legs in good natural healthy condition are too obvious to need to be insisted on.

In the west of Scotland, notwithstanding that the climate is more severe than in the south, and the moisture greater than in the east, an effort is made to winter young stock outside, but not generally, as in the south, with no shelter but the stone dykes or plantations. There are always sheds in the fields in which the stock take shelter in rough weather, and without these it would be risky in a severe season to winter outside. The main point, however, is to feed well; and even in a bad winter, if the youngsters are in good heart, they can be independent of artificial shelter. Along with what they can pick up, the foals may get about 8 lb. each daily of bruised grain mixed with chopped hay, fed one half in the morning and the other in the evening. Sometimes they are fed thrice, and the daily quantity is then about 12 lb. each. Fillies intended to be shown are fed five times daily on the rough boiling, cut sheaves, bruised oats, meal drinks, &c., specified for brood mares, but in lesser quantities.

Mr Howie has found the feeding of foals with a few green tares at evening time give satisfactory results. The youngsters eat these more eagerly than hay, and do not lose middle so readily. They afterwards get bruised oats and a little linseed-cake, with raw turnips twice a-day, and boiled corn mixed with chaff and bran and treacle once a-day. In the Hazelrigg stud foals are housed at night.

Mr Chapman's method of weaning is interesting, because differing somewhat from that followed in Scotland. The foals are weaned gradually. During the last month the mare is wrought during the day, and goes back to the foal at night.

Afterwards the foals have the run of a paddock, with a shed in it where they are fed, but the weather must be very bad when they lie down in it. They get as much as they can eat of hay, chaff, bran, and bruised oats mixed together, but no other corn. In increased quantities this continues to be their food as they grow older, and until put into the yoke.

In the majority of studs in Scotland, up to about 1880, the question, What is to be done with the colt foals? required sooner or later to be settled; but, thanks to the keen foreign demand for breeding stallions, since that year, except in rare cases, the operation of castration has rarely to be performed. Breeders should, however, castrate more colts than they have done in recent years, as a good gelding is better than a bad stallion, and to secure the former the colt should be castrated before he is two years old. When kept too long entire, the horse becomes coarse and too rough about the legs, while he is more restless, and never thrives so well. The best way to treat colts, with a view to the greatest public good, is to castrate all but the best when they are yearlings, either in April or October. A race of indifferent stallions would thus be prevented, and a race of superior geldings produced.

In many of the smaller farms, where only one or at most two breeding mares are kept, it is customary to sell the colt foals when weaned to stallion owners, who winter them very much as yearling fillies are wintered. An extra good colt may in some cases have a well-fenced retired field of young grass to himself, where he runs at pleasure, and receives some little hand-feeding during the depth of winter. Generally, however, although owners would prefer to keep colts out all winter, the usual practice, except in one or two of the larger studs, in the south of Scotland, is to house them at night and run them out during the day.

During the month of May, Mr Matthews, who this winter (1889-90) has six colts rising one year old on hand, discontinues hand-feeding—as the "rest" from strong food, when the grass is good, causes the colts to benefit all the more by it when it is resumed. Bruised oats, cut hay, and a little linseed-cake—in all, from 12 lb. to 16 lb. per head—along with grass, is found to be a good daily supply, divided into three equal parts. Mr Kilpatrick's daily allowance per head for yearling colts is 10 lb. chop, with 6 lb. carrots, fed in three equal parts. Mr Taylor's treatment is somewhat different. He feeds four times daily, with first diet of rough boiling in early morning; a little bruised oats, cut hay, and bran at nine o'clock, and the same when the colts come in at five o'clock; boiled food as in the morning about eight P.M., and some long hay in each rack. In Mr Renwick's stud the feeding is a boiled mash night and morning, consisting of a few Swedish turnips, bean sheaves chopped as they grew, cut hay, and a little bran. The other winter feeding consists of two diets of bruised oats and cut hay, mixed with a very little bran and salt, and damped with water. During summer, when running out, these colts get nothing but what they gather.

Mr Weir's colts run at grass all the year round, but have a wooden shed in the field, where they are fed and can take shelter. He feeds twice a-day on boiling, consisting of light oats, barley, chopped straw, and bran, with two feeds of chopped hay and bruised oats mixed. They get as much of the boiled food as they can eat: the chopped straw forming the greater part of the mixture, there is little chance of them hurting themselves. They receive no hand-feeding during four months in summer when the grass is good. The foregoing may be described as good commercial feeding—the colts so treated being mostly intended for the foreign market, and hence kept in good, natural, fresh condition. For showyard purposes yearling colts are treated much the same as yearling fillies,—the differences, as compared with trade colts, being mainly in respect of quantities.

Entire colts rising two years old should be boxed as early as possible,—most owners preferring to have them taken off the grass about the middle of September. When allowed to run out too long they are apt to lose condition, and to become round-looking in bone. However, there is considerable diversity in regard to this, and often, whatever their desires may be, owners are forced to keep the colts out until well into winter. Mr Kilpatrick houses such colts about the middle of October, but they run out daily in separate paddocks until February. Their feeding consists of 15 lb. chop and 9 lb. carrots per head daily, with a mash at night, consisting of boiled beans, peas, oats, rye, and Indian corn, mixed with bran and a little oilcake-meal when drawn from boiler. After February they are handled very gently, no sticks being allowed, and exercised daily by walking about two miles.

Mr Taylor feeds five times daily—at 5 A.M., 9 A.M., 12 noon, 5 P.M., and 8.30 P.M. The diet consists of rough boiled food—barley, Indian corn, cut hay or straw, turnips or cabbages, with some bran—alternately with bruised oats and cut hay raw, and at 12 a mixture of cut hay and bran steamed. Sometimes raw turnips pulped are found good feeding, but all colts cannot be got to eat them.

Around Park Mains steading there are a number of splendidly walled paddocks of about half an acre each in extent, and in these the colts are exercised for an hour or two each day. Stallions of maturer years are also exercised in the same way until the month of February, when they are exercised more systematically.

Mr Renwick's two-year-olds are wintered all together in a cattle-court, and get each about 14 lb. grain of one kind or another in twenty-four hours. They do very well when thus housed, and four or five together do not fight so much as two. They are out in paddocks during the day, and the courts are then occupied by three-year-old and aged horses—two occupying them in the forenoon, and two in the afternoon. As there are two courts, this exercises four horses daily; and should there be more in the stud, as there are at present, they are led out singly for exercise two or three miles.

The winter feed of colts rising two in Mr Lang's stud is per head a small quantity of cold boiled food morning and evening. At 10 A.M., oats (say 1 lb.), with cut hay; 1 P.M., steamed cut hay, with oats and bran (say 1 lb. of each); and at 8 P.M., oats and cut hay, about 1 lb. of each.

The due exercising of colts of this age is the great cause of expense in their management. To lead all of them in a large stud out singly day by day for the length of time that is required to give full exercise, would necessitate the employment of more hands than there would be adequate labour for at other seasons, and hence numerous expedients have been resorted to to enable the colts to exercise themselves. Some of these have already been referred to. Mr Charlton utilises the cattle-boxes in summer for this purpose. They measure 11 feet by 32 feet; the stud-box measures 18 feet by 24 feet in outer yard, and 12 feet by 15 feet in the inner box. Horses occupying these receive no other handling.

Mr William Montgomery, at his farm of Banks, Kirkcudbright, has two sets of boxes formed of railway-sleepers set on end and roofed with galvanised iron. In the older of these sets there are two rows built at right angles, and containing five or six boxes each. These boxes open into a large court fenced with railway-sleepers about 8 feet high. Into this the occupants of the boxes are alternately turned each day, and thus exercise themselves to the full. The new set of boxes contains one row opening into a court like the other, and utilised in the same way. One objection to this plan is that the colt, being exercised in the yard, disturbs and excites those in the boxes; and some owners have a court at some distance from the boxes, into which the horses are turned for a time each day. This, of course, entails more labour, as the colt has to be haltered both to lead out and to bring in, and more time is consumed than with the plan followed in the Banks stud. The court in front of the Garneyland boxes is 40 yards long by 8 broad, which provides sufficient room for exercise; but a colt that is intended to be shown requires to be haltered and handled daily, or he may not prove too pliable in the show-ring.

The stallion and breeding boxes in the Balbirnie stud merit a special description. They are strong, useful, convenient, and roomy, with exercise-courts in front of each box, subdivided by walls 9 feet high, with a strong wooden fence in front of the whole 8½ feet high. This fence is made up of larch posts set into a block of cement, with nine larch rails 6 inches by 1¼ inch let into the posts. There are suitable gates and sliding-doors on each exercise-court and box. The size of the boxes varies from 14 feet by 11 feet to 14 feet by 14 feet, and 14 feet by 16 feet, and 14 feet by 18 feet. The walls are of common rubble, and the roofs of tile. In some of the boxes the floor is formed of a clay-lime-and-ashes composition, while in others it is formed of railway-sleepers. The inside walls are plastered with cement 6 feet up, and quite smooth. There are also three stallion-paddocks, two an eighth of an acre each, and the third about 1½ acre in extent. The two smaller paddocks are fenced with sleepers set on end 3 inches apart and 7¼ feet high, stiffened by a strong larch rail along the top. There is a comfortable box in the corner of each paddock 12 feet square, and made of sleepers set on end, with a felt-covered roof. A full-grown stallion has been wintered in each of these paddocks during the past season, the doors of the boxes being open continually.

In the stud of the Marquis of Londonderry, at Seaham Harbour, there are several such paddocks in which stallions are regularly wintered, and there can be no doubt that a more healthful mode of wintering entire horses could not be devised. Plainly, however, it is only the few to whom such paddocks, removed from highways and securely fenced, are possible; and owners of horses less favourably situated have therefore to content themselves either with exercising their horses by hand, or if they do turn them out in the daytime, they have to blindfold them to prevent accident.

In preparing three-year-old and aged stallions for the show-ring and stud, great diversity of treatment prevails; and few definite figures can be obtained as to quantities, because what one horse will fatten on will not be of much use to another. Generally, however, the feeding does not materially differ from that already specified as given to younger stallions, except that linseed-cake is frequently added, say in quantity about 2 lb. per day to each horse. Carrots, beans, barley, bruised oats, cut hay, bran, Swedish turnips, and linseed, well seasoned, constitute good stallion food. The horse requires to be fed four or five times daily, and care should be taken to see that he always relishes what is given to him. Mr Matthews thinks the extra feeding should be begun in August or September, but others name November or December as soon enough. A great deal will depend on how the horse finished his last season if he be an aged horse, and in what shape he has been summered if a two-year-old. Beginning about the middle of December, and increasing the quantities gradually, Mr Kilpatrick thinks a horse should come out in spring in excellent form on the following rations: At 5 A.M. mash, consisting of 2 lb. oatmeal well boiled, and mixed with 2 lb. bran and cut hay, sweetened with treacle; 8.30 A.M., open rough mash of boiled beans, &c.; 12.30 P.M., 5 lb. chop, with 3 lb. carrots; 5.30 P.M., mash of boiled beans, &c.; and at 8.30 P.M., 5 lb. chop, with 3 lb. carrots. Always water before feeding, and give as much green cut as the horse will take.

The following are the proportions of food constituting the chop used in the Craigie Mains stud—viz., 10 cwt. oats, 1 cwt. beans, 1 cwt. peas, 1 cwt. Indian corn, $\frac{3}{4}$ cwt. best home nut-oilcake, and $1\frac{1}{2}$ cwt. cut hay mixed—obviously rich concentrated food, capable of promoting not only wealth of flesh, but also muscle, bone, and sinew.

Mr Charlton gives the following recipe as in use in his stud from January onwards: A little less than two-thirds bruised oats to one-third bran, one-eighth beans, and one-twentieth linseed-meal. Three bushels of this per week, fed four times daily, with a little cut hay given in a damp state, is good feeding for an entire horse.

Heavy horses, intended for stud purposes, usually have their shoes removed on completion of the season in September, and the feet dressed during winter in much the same way as has already been recommended for other classes of stock. A horse with a brittle hoof, however, cannot be allowed to run promiscuously barefoot, and when running in a paddock is very apt to throw a shoe or break the hoof. Hence some horses are always boxed and exercised on hand. A stallion in this case, or one confined from any other cause, should never have less exercise than a two-miles walk per day, and this should be gradually increased as the time for opening the season draws near. It is generally considered that it is sufficient for horses that are run in paddocks, that they get hand-exercise about a month before the season opens; but there can be little doubt that this is too short a time for a horse that has been exercised on turf for four months to acquire freedom of step for, and become seasoned to, a journey of ten miles on a hard road. If a horse is to begin to travel on 15th April, he should, from the beginning of the year at latest, have a walk of three miles each morning, and a walk of equal length each evening. When a horse has been exercised in this way, even if in high condition, his muscles are firm and hardened, and his work is no trouble to him. He is not likely to break down on his journey; and just as the old stallions, that were wrought during winter, used to leave a larger percentage of mares in foals than our fashionable showyard favourites, the horse thus exercised will give greater satisfaction and leave more foals than a stall-fed, neglected animal. Of course winter treatment such as is here suggested would entail some additional expense, but there is reason to believe that this would be more than met by the increased fees for foals that would be realised.

About a month before the opening of the season, the stallion should receive less sloppy food, fewer mashes, and more concentrated stimulating feeding; and when once at his work he should get as great a quantity of bruised oats mixed with beans as he will take, be fed often, but never with a greater quantity than 3 lb. at a time, and receive a mash with a good proportion of bran in it every night until cut grass can be had, when the mash may be discontinued. He should be allowed to drink plenty of water, but on no account should he be given meal drinks. Twenty-two lb. of grain per day is considered to be sufficiently strong food for a stallion while travelling; and a little saltpetre has been found to be useful, given once a-week, until green cut grass can be got. This acts as a natural aperient, and with judicious management no other medicine should be necessary.

This paper might be considerably enlarged were I to furnish details regarding the various methods *once* in vogue for making horses, somewhat deficient in essential points, appear to possess them; but in the first place, as already hinted regarding the females, it would hardly be in accordance with the traditions of the Highland and Agricultural Society to make its official publications a medium for giving publicity to nostrums of doubtful advantage; and secondly, because, although such were *once* in vogue, the answers to the inquiries on which this paper is based make it clear that the day of these is past, and right-minded persons will re-echo the sentiments of Mr Kilpatrick, who says in regard to two of the most crucial points in a show-horse: "Always purchase an animal with a good hoof-head, as no artificial means can be used to improve it that I have been able to find. I don't approve of using artificial means to promote growth of hair; it will come with age."

As a harmless and legitimate method of inducing an evenly growth of hair, cutting off the ends has been found useful, and blistering the hoof-heads may induce a growth that gives an appearance of greater width; but there is sufficient evidence, were this the place to refer to it, that such at best is only an appearance. After a year or two the hoof assumes its natural form, and no amount of blistering, in ordinary cases, will then impart even the appearance; while under the treatment, if it be persisted in, the horse may sicken and die. The one safe thing to do with the foot, is what has been already referred to. During winter keep it low at the heel and short in front, bringing the pressure to bear on the frog and heel; and during summer remove the shoes frequently, so that the foot may grow naturally and freely. At all times prohibit the farrier from rasping and polishing the outside of the hoof.

THE CEREAL AND OTHER CROPS OF SCOTLAND FOR 1889, AND METEOROLOGY OF THE YEAR RELATIVE THERETO.

THE CROPS.

THE following comparison of the cereal and other crops of 1889 with the previous year, has been prepared by the Secretary of the Society from answers to queries sent to eminent agriculturists in different parts of the country.

The meteorology of the year has been furnished by Dr Alexander Buchan, Secretary of the Meteorological Society of Scotland.

The queries issued by the Secretary were in the following terms:—

1. What was the quantity, per imperial acre, and quality of grain and straw, as compared with last year, of the following crops? The quantity of each crop to be stated in bushels. What quantity of seed is generally sown per acre?—(1) Wheat, (2) Barley, (3) Oats.
2. Did the harvest begin at the usual time, or did it begin before or after the usual time? and if so, how long?
3. What was the quantity, per imperial acre, and quality of the hay crop, as compared with last year, both as regards rye-grass and clover respectively? The quantity to be stated in tons and cwts.
4. Was the meadow hay crop more or less productive than last year?
5. What was the yield of the potato crop, per imperial acre, as compared with last year? The quantity to be stated in tons and cwts. Was there any disease, and if so, to what extent, and when did it commence? Were any new varieties planted, and with what result?

6. What was the weight of the turnip crop, per imperial acre, and the quality as compared with last year? The weight of the turnip crop to be stated in tons and cwts. How did the crop braird? Was more than one sowing required? and why?
7. Were the crops injured by insects? State the kinds of insects. Was the damage greater or less than usual?
8. Were the crops injured by weeds? State the kinds of weeds. Was the damage greater or less than usual?
9. Were the pastures during the season of average growth and quality with last year?
10. How did stock thrive on them?
11. Have cattle and sheep been free from disease?
12. What was the quality of the clip of wool, and was it over or under the average?

From the answers received, the following statistics have been compiled:—

EDINBURGHSHIRE.—Wheat, a very good crop; fine quality; yield, 48 bushels; seed sown, 3 bushels; very large crop of straw, 15 cwt. more than last year; wheat on heavy clay land was very much laid. Barley, very much laid, and a great deal of waste; quality fully as good as last year; yield, 48 bushels; straw, a bulky crop, and quite unsaleable at 25s. per ton. Oats, very much laid, and very bad to reap, with a great deal of waste; yield, 50 bushels; straw, a large crop, about the same as last year. Commenced harvest eighteen days earlier than last year. Hay, about 3 tons; fine quality, superior to last year; 10 cwt. more than the former year. No meadow hay. Potatoes, double the crop as compared with last year; 9 or 10 tons; about a third diseased, commencing middle of October—I refer to Regents; planted a few acres of the Bruce, a new variety; large crop and no disease—indeed they were the crop of the season. Turnips, excellent crop last year; 25 to 30 tons; better quality than the former year; fine braird; only once sown. No injury by insects or weeds. Fine pastures, better than the former year. Stock throve on them, and were free from disease. Clip of wool, about the average.

LINLITHGOWSHIRE.—Wheat, about the same in quantity, but better in quality of both grain and straw as compared with last year; from 30 to 40 bushels; seed from 2½ to 3 bushels. Barley, about the same quantity and quality of straw; grain better in quantity and quality as compared with last year; from 30 to 40 bushels; seed from 2½ to 3 bushels. Oats, about the same quantity and quality of straw; grain better in quantity and quality as compared with last year; from 30 to 40 bushels; seed from 4 to 6 bushels. Harvest began and ended about a month sooner than last year. Hay, about the same quantity, but much better in quality than last year; from 1½ to 2½ tons. Meadow hay, good, but very little grown in the district. Potatoes, better in quantity and quality as compared with last year; from 6 to 12 tons; some disease when lifted, and continued to increase in the pits. Turnips, better in quantity and quality as compared with last year; not much second sowing; from 15 to 25 tons. No damage by insects; crops not injured by weeds. Pastures better than last year. Stock throve well, and were free from disease. An average clip of wool.

HADDINGTONSHIRE (Upper District).—Wheat, none grown. Barley, 27 to 34 bushels, weighing 55 and 56 lb.; straw good, and on some farms much laid; 3½ bushels seed sown. Oats, 38 to 40 bushels, weighing 43 to 45 lb.; straw, large crop and fair quality; seed, 4 bushels. Harvest commenced 2d September, a month earlier than last year. Hay, from 2 to 3 tons; strong and good quality. Meadow hay, better than last year, but a little damaged by rain in the manufacture. Potatoes, 5 to 8 tons this year, a half more than last year; not much disease apparent when lifted, but shown in pits; no new varieties. Turnips, 13 to 20 tons; better crop than last year; good braird, and no resowing necessary. No injury by insects this year. Wild mustard very prevalent on some fields. Pastures very good. Stock did well on grass; no disease. Average clip of wool, of good quality.

HADDINGTONSHIRE (Lower District). — Wheat, 40 bushels; immense crop of straw; both grain and straw fair quality; straw about double the crop of last year; 3½ bushels seed sown. Barley, 44 bushels, weight 56 lb.; quality better than last year; average straw; 2½ bushels seed sown. Oats, 50 bushels; weight 44 lb.; average quality; straw about same as last year; 4 bushels seed sown. Harvest began 15th August or about three weeks earlier than last year, and bad weather, which made a long harvest. Hay, about the same quantity as last year (2 tons); fair mixture of rye-grass and clover; fine season for making it, and is of better quality than last year. Potatoes, about double the crop of last year (8 tons), fine quality; a little more disease than last year. Turnips, 25 tons, good quality; one sowing; brairded well. Pastures, quite as much grass as last season. Stock throve rather better than last year. Full average clip of wool, good quality; price about the same as last year.

BERWICKSHIRE.—Wheat, a greater yield and better quality than last year; 34 bushels; 3 bushels of seed. Barley, better yield and better quality; 36 bushels; 3½ bushels seed. Oats, much the same quantity; better quality; 40 bushels; 4 bushels seed. Harvest rather before the usual time. Hay, 1 ton, 15 cwt.; quality good. Meadow hay, more than last year. Potatoes, 5 tons; not much disease. Every kind of turnips were larger than last year; 21 tons; first-sown turnips brairded well; the later-sown did not braird until rain came, 20th July; no resowing. Pastures, above average. Stock throve well. Cattle and sheep free from disease, except foot-rot. Clip of wool, good quality, average weight.

ROXBURGHSHIRE.—Wheat, small breadth grown; above an average crop, and quality good; about 30 bushels; straw where not laid good; generally seeded with 3 bushels. Barley, varies much both in grain and straw; quality fair; quantity about 35 bushels; considerably less straw than last year; seeded with about 3 bushels. Oats, the best crop of the season both as to quality and quantity; about 42 bushels; quality as good on the higher districts as the lower; straw excellent quality; seeded with about 4 bushels. Harvest one month earlier than 1888; generally finished within the month. Hay crop was a good one in every respect; about 1½ ton, and remarkably well got. Meadow hay, fully an average crop; above last year's and better got. Potatoes, generally a large crop, but a considerable deal of disease among the Regents; the other varieties tolerably free; about 5½ tons. Turnips, the largest crop that has been grown in the county for a good many years; very little second sowing; about 23½ tons. Almost no damage done by weeds. Pastures, very good and abundant. Stock did well. This county has kept wonderfully free from disease. Clip of wool, fully average.

SELKIRKSHIRE.—Wheat, none grown. Barley, 40 bushels; quality better than last year of both grain and straw; 3 bushels sown. Oats, 30 to 36 bushels; grain and straw good quality, and well got; straw extra bulk. Harvest began at the usual time. Hay, 2 to 2½ tons; good quality but not much clover. Meadow hay was a large crop and fairly well got. Potatoes, full average crop and quality good; 5 to 6 tons; the Bruce was planted on some farms, and a good crop. Turnips, 15 to 20 tons; quality better; crop brairded well, and almost no second sowing. No damage by insects. No damage beyond the average by weeds. Pastures, an extra growth, but quality not so good. Stock throve well, but didn't fatten so well as usual. Occasional cases of disease, but not widespread. Clip of wool, quality was very good and a full average, and prices rather over last year.

PEEBLESSHIRE.—No wheat. Barley, a fair crop, averaging about 36 bushels, with plenty of straw; a much better crop than last year; 3 to 4 bushels seed sown. Oats, a very good crop, yielding from 32 to 40 bushels; straw over an average; altogether a better crop than has been grown for some years; 4 to 5 bushels sown. Harvest commenced about ten days earlier than usual. Hay crop was good; about 3 tons; generally secured in splendid condition; much heavier than last year. Meadow hay was a very good crop; what was cut early was secured in good order; but owing to showery weather further on in the season a considerable amount of damage was done, and the hay was put together in bad condition. The potato crop was one of the heaviest on record; the yield would average 12 tons; there was almost no disease. The turnip crop was also a magnificent one; from 15 to 25 tons. The crop brairded well, and in very few cases was second sowing required. No injury by insects or weeds. Pastures were good; better than the previous year. Stock throve well. No disease among sheep, but there was a slight outbreak of pleuro on one farm in the autumn. Clip of wool above average.

DUMFRIESSHIRE (Upper Nithsdale).—Wheat, none grown. Barley, none grown. Oats, decidedly over an average crop; 40 bushels; straw and grain of good quality and well harvested; seed sown, from 5 to 6 bushels. Harvest about the usual time, and quite a fortnight earlier than the previous year. Hay, barely an average generally, and on light land a poor crop, owing to hot dry weather in June; clover a very poor crop. Meadow hay, an average crop, but less than last year; fairly good quality, except that secured during end of season. Potatoes, above an average, 8 tons; quality good, and little disease amongst later varieties. Turnips, very heavy crop and of good quality; 20 tons; braird strong and vigorous, and no resowing necessary. Very little and less than usual injury by insects. In some cases, where turnips not sown in proper season, annual weeds somewhat troublesome. Pastures, more than average growth, and of good quality where fully stocked during early summer. Stock throve fairly well, especially in the case of sheep stock. Cattle and sheep free from disease. Clip of wool, quality good, and much over average of recent years.

KIRKCUDBRIGHTSHIRE.—Wheat, 32 bushels; quality not equal to last year; seed, 2½ to 3 bushels. Barley, 34 bushels; quality similar to last year; straw considerably shorter; seed, 3 to 4 bushels. Oats, 32 bushels; quality better than last year; straw very much less, probably ⅓; seed, 4 to 5 bushels. Harvest about fourteen days earlier than usual. Hay, 1¾ ton, quality very superior. Meadow hay, less productive. Potatoes, 8 to 12 tons, a very fine crop of good quality. Turnips, 20 to 22 tons average, a very superior crop; brairded well, except some sown middle of June; no resowing required. A very little injury by wire-worm. Considerable quantities of charlock in many fields of oats. Pastures, far above an average in yield; quality under average. Stock throve moderately well, and were free from disease. Clip of wool, quantity and quality a full average.

WIGTOWNSHIRE.—Wheat, 36 bushels; quality good; straw, 1¼ ton; crop generally superior; 3 bushels seed used. Barley, 42 bushels; good weight, but colour not good; straw, 1 ton; 4 bushels seed. Oats, 40 bushels; average quality; straw, 1⅛ ton; 4 bushels seed. Harvest earlier by about ten days. Hay, 1 ton 10 cwt.; quality very good. Meadow hay, much the same. Potatoes, very good yield; 10 tons; no disease; no new varieties used; small area under potatoes. Turnips, 20 tons, much superior to last year; brairded well; no resowing required. Pastures, great growth, but very inferior in quality. Stock throve not satisfactorily; results were very disappointing; free from disease. Clip of wool, somewhat over an average, and very good quality.

AYRSHIRE.—Wheat, the bulk of straw was less than in the previous year, but quantity and quality were both superior; there is a concurrence of opinion in stating the average yield at about 40 bushels; weight of straw 1½ to 2 tons; quantity of seed, 3 bushels in the lower districts, and up to 4 bushels on later land. Barley is grown mainly in the earlier districts of Ayrshire; some big crops, but average is probably from 40 to 42 bushels; straw abundant. The oat crop looked unusually well in its early stages of growth, but it was afterwards stinted by drought on light land; on the deeper inland soils the crops were bulky and productive; the yield might be about 48 bushels on the average, and the quality was good; amount of seed 4 to 5 bushels. In Carrick, which has generally a lighter soil than Kyle or Cunningham, oats were under an average both of grain and straw. Harvest began about the usual time; it was about ten to fourteen days earlier than in 1888. Hay was a good crop; it came away rapidly in May, but clover was generally deficient. The average yield of rye-grass hay might be about 35 cwt. The quality in the upland was better than in the previous year. Meadow hay was a good average crop. Potatoes, the early crop, though rather deficient in quantity, was much more profitable than the fine crop which was matured in autumn. In the first five weeks of raising, the produce might average 4 to 5 tons. The late crops were very productive, but on inland farms the finer varieties gave way to the extent of about ¼ in the pits. The turnips were almost everywhere a very heavy crop; there was little resowing. In Carrick the crop was estimated at 8 to 10 tons above the produce of the previous year. Over the county there was probably a crop of nearly 25 tons. Little damage by insects. No great damage from weeds, less than usual. The pasture was abundant in the early part of summer, but it suffered from drought afterwards. The feeding quality was good in summer, and the autumn growth was plentiful. Stock did well, notwithstanding the injury by drought at midsummer; the autumn made up deficiencies. A few outbreaks of pleuro-pneumonia occurred, but stocks were generally healthy. The clip was over the average both in quality and quantity.

BUTE.—Wheat, none grown. Barley, a good crop generally; yield, about 40 bushels; grain and straw of good quality; seed sown, about 4 bushels. Oats, crop above the average; yield, about 38 bushels; grain of good quality and straw bulky; seed sown 5 to 6 bushels. Harvest began earlier than usual; commenced about the middle of August. Hay, a good crop; fully 2 tons. Timothy about 2½ tons. Both uncommonly well got, with less labour than usual. Meadow hay, an average crop; not much in this island. Potatoes, good crop; about 8 tons; little or no disease; no new varieties worthy of note. Turnips, from 20 to 32 tons; quality excellent; brairded well; no resowing owing to favourable weather. No injury of consequence by insects. No serious injury by weeds, the dry season being against their growth. Pastures, above an average both as regards growth and quality. Stock throve well. Cattle and sheep free from disease, except braxy amongst blackfaced hoggs, which has been heavier than usual. Clip of wool, good, above an average.

ARRAN.—Wheat, none. Barley, none. Oats, about 34 bushels; rather less straw than last year, but quality quite as good. Oats, heavier than last year; about 6 bushels sown. Harvest, about two weeks earlier than last year; began about 20th of August. Hay, crop better, about 1 ton 15 cwt.; little or no clover. Meadow hay, none. Potato crop, better than last year; about 7 tons; almost no disease; no new varieties. Turnips, extra crop; about 24 tons; brairded well; no resowing. Pastures, quality and quantity good in the early part of the summer, but burnt up with the dry summer, end of June and July; and strong growth again in fall. Stock throve fairly well, and were free from disease. Clip of wool, quality better than last year, and rather over average quantity.

LANARKSHIRE (Upper Ward).—Wheat, none. Barley, almost none. Oats, from 30 to 60 bushels; average of Upper Ward about 36 bushels; good crop on heavy land, on light land the rain too long in coming, but a fair good crop, both straw and corn of the best quality; straw less than last year, but more corn, at least 3 bushels, and 1 lb. heavier; seed 5 bushels. Harvest, about a fortnight before. Hay, from 1½ to 2 tons, no more than last year, but better got; quality better. Meadow hay, fully better than last year; quality better. Potatoes, from 7 to 12 tons, nearly double last year; very little disease; mostly Regents in this quarter, a few Magnums and Champions. Turnips, from 20 to 35 tons; better quality than last year, and at least 5 tons more; brairded well; no more than one sowing required. Less than usual injury by insects. Wild mustard bad on grain crops, but easily cleaned on green crops, the weather being dry; damage less than usual. Pastures, better than last year after the rain in July. Stock throve fairly well. Cattle and sheep free from disease. Clip of wool, about the same.

LANARKSHIRE (Middle Ward).—Wheat, a good crop, but much laid by wind and rain; had to be hand-shorn—very expensive harvesting; where standing, quality good; lying fields, quality bad; yield, 36 bushels; seed 3½ bushels, sown broadcast; straw, 150 stones (22½ lb.) Barley, very little grown; where it was good crop, yield 40 bushels; seed sown, 4 to 5 bushels. Oats, fully an average crop; yield, 42 bushels; quality good; straw bulky and firm; seed sown, 5 bushels. Harvest, generally a fortnight earlier. Hay, 2½ tons, quality very fine compared with last year; exceptional weather for haymaking here. Meadow hay, much about same, but firmer grown; bad weather for making it. Potatoes, yield 3 to 4 tons more than last year, 12 and 13 tons common occurrence; no disease until a month after storing. Turnips, about 20 tons, good quality; no second sowing; brairded well. No damage by insects; a few cases of wire-worm; damage less than usual. No injury by weeds to speak of. Pastures, better quality than last year, and fully an average growth. Stock throve very well; an odd case of pleuro-pneumonia; foot-rot bad in sheep at end of season owing to wetness. Clip of wool, quality very good and better than last year.

LANARKSHIRE (Lower Ward).—Wheat, in general a heavy crop; much laid and difficult to cut; yield, from 36 to 38 bushels; straw, from 150 to

160 stones; seed, from 3 to 4 bushels. Barley, none grown. Oats, an extra heavy crop, but badly laid, owing to the wet weather before harvest; a great deal had to be cut with the hooks at extra expense; yield, from 38 to 40 bushels; straw, from 150 to 170 stones. Harvest about a month earlier than last year; weather good, and crop well secured. Hay, a good average crop; fine weather, and extra well got; well mixed with clover; yield, from 1 ton 10 cwt. to 1 ton 15 cwt. Meadow hay, about the same quantity as last year, but not so well got as the rye-grass hay. Potatoes, an extra heavy crop; not much disease when lifting, but in some cases did not keep well in pits; average yield, from 6 to 10 tons; heard of no new varieties. Turnips, a very heavy crop; in some land the growth went rather much to shaws owing to the open season; weight, from 15 to 20 tons; crop brairded well; no second sowing required. No damage from insects. Weeds not so troublesome as last year. Pastures, extra good all the season. Stock did well; no disease among cattle and sheep in this district. Clip of wool, quantity and quality much the same as last year.

RENFREWSHIRE (Middle Ward).—Wheat, 50 bushels. Barley, 30 bushels. Oats, 60 bushels. Harvest, about two weeks earlier. Hay, quantity somewhat similar to last season; quality superior. Meadow hay, similar to last season. Potatoes, 12 tons. Turnips, 25 tons. Crops not injured by insects; no injury by weeds. Pasture, all over superior. Stock throve well; no disease in this immediate district. Clip of wool, average.

RENFREWSHIRE (Upper Ward).—Wheat, none grown. Barley, none grown. Oats, started sowing on 1st April; 5 bushels short oats, and 6 bushels long; brairded well, and with the fine weather in May was an abundant crop, and harvest was ready by the end of August, and would yield from 30 to 36 bushels. Harvest from three to four weeks earlier than last year. Hay was as heavy a crop as last year, and well got; splendid quality, and 40 cwt. Meadow hay was a fine crop, and well got; about 40 cwt. Potatoes were a good crop; very little disease, and good quality; they would average from 6 to 10 tons; Regents and Champions mostly grown. Turnips were a splendid crop; brairded well, and no second sowing required. There was no damage from insects or weeds this year; being a fine season and rapid growth, neither weeds nor insects could do any damage. Grass grew very rapid in May—have not had as good grass for many a year. Cattle did well; they had fine warm weather and plenty of grass. A good deal of pleuro among cattle. Not many sheep kept here.

RENFREWSHIRE (Lower Ward).—No wheat and no barley grown. Oats after lea; the straw was bulky, and the average return from 26 to 30 bushels; but on red land, as is usually the case in this locality, the crop was poor, both as to straw and yield of grain. The weather was better than on an average of seasons. The harvest was not so early as was expected, and while the rainfall was much below the average, absence of sun and hot days prevented crops coming to maturity so soon as was at one time anticipated; at the same time, the season generally was a good one. The quantity of seed sown was 4 to 5 bushels, and while the yield of straw was less in quantity, the quality was good. Rye-grass hay, from the favourable weather to secure it, was of excellent quality, but there was almost a complete absence of clover, and this had an unfavourable effect on the aftermath, which in consequence was not a bulky crop; the average weight of hay would be from 1 to 1¾ ton; price, however, has ruled low. Meadow hay was an exceptionally heavy crop, and in some cases, where irrigation is systematically carried on, yielding

25 per cent more crop than the average, and the quality was very good. The potato crop was very good, and above average by about 1 ton; the quality fine, and the yield equal on an average to 7 tons; little disease showed itself, except in Regents, and they were affected to about one quarter of the crop; the Bruce, a new variety, has been planted in several places with excellent results, and have proved to be a heavier cropper and better quality than Magnum Bonums; but it is a coarse kind, and has not yet had time to be fully tested. Turnips were a fine crop, and much above the average in quantity and quality, and fly gave little trouble; the yield, according to the treatment the land had received, would be from 17 to 25 tons. Insects, as a rule, did less damage than in average years; wire-worm no doubt appeared, more especially in the high red-land. Weeds had no right to make way if due attention was paid to keeping them under control. Pasture did well, and stock throve, and both cattle and sheep have been free of disease. Hill sheep clipped well, and the exceptional abundance of hill pastures and the favourable weather turned sheep off the hills in better condition than has been the case for many years; this helped to maintain the price of sheep at a high figure, and flock-masters will recollect 1889 as one of the best years on record since the 1860's, although wool has not given much, if any, increase of price. The rainfall of 1889 has been 49·53 inches, which is 9·27 inches below that of 1888, and 16 inches below the average.

ARGYLESHIRE (District of Oban).—No wheat sown. No barley sown. Oats, the quality was good and yielded about 6 bushels more than last year (from 5 to 6 bushels); straw was a little under the average crop; this was caused by dry and hot weather in June and July. The harvest began about the same time as last year. The rye-grass was a good crop, yielding about 8 cwt. more than last year. The clover was a light crop. Meadow hay, where the soil was damp the crop was very heavy, and where it was dry it suffered from the dry season; taking it all over, the crop would be an average. Potatoes, yielded about 1 ton more than last year; disease did not appear till September and did little damage; no new varieties were sown. Turnips, a good crop; about 2 tons more than last year; in the early part of the season this crop suffered from dry weather and did not braird well; in several instances it was sown twice; it made good progress farther on, and the crop was good. Weeds are well kept down, but they were not troublesome owing to the dry season. The pasture was very good early in the season, above the average, but it was much checked in the month of July by dry weather. The stock did not thrive quite so well, but there were few complaints Clip of wool, the quality was over the average.

ARGYLESHIRE (District of Lochgilphead).—Wheat, none grown. Barley none grown. Oats, land varies very much in the district from peat to light gravelly land—say, 5 bolls as the average. Harvest, later than was at one time expected, July being a cold month; began about the usual time. Rye-grass, a good crop, 1½ ton; rather better than last year. Meadow hay, about the same. Potatoes, a fine crop; 7 tons as compared with about 6 tons last year; very little disease; no new varieties to speak of used. Turnips, a very heavy crop; no weights can be given. No injury by insects; no injury by weeds. Pastures, fully better. I have seen stock put on condition more readily than they did. The clip of wool was good; above the average.

ARGYLESHIRE (District of Kintyre).—No wheat grown. Barley, about 5 quarters; grain, better than last year's; straw, not in such quantity. Oats, same answer as to barley. Harvest began at usual time; earlier than 1888. Hay, about 2 tons; quality better. Meadow hay, more productive than last. Potatoes, about 5 tons; almost free from disease; several new varieties succeeded well—viz., "The Bruce," "The Maggie." Turnips, very good, 20 tons, very well. Rats numerous and destructive. Pastures, better; May, extra good; June and July, dry. Stock throve well. Clip of wool, heavier, above average.

ARGYLESHIRE (Islands of Islay, Jura, and Colonsay).—No wheat grown in this district. Barley, very little grown; crop was rather better than last year; straw, slightly less bulky, but grain heavier and better. About 4 bushels usually sown, and average yield 40 bushels. It is only on the better class of soil that any barley is grown. Oats, straw less bulky than last year, but grain heavier and better; yield last year about 34 bushels, and this year 37; quantity of seed usually sown from 5 to 6 bushels. The harvest was a fortnight earlier this year than last. Hay, last year yield about 1 ton 2 cwt.; this year, 1 ton 6 cwt.; quality this year much better than last. The meadow hay was not quite so productive this year as last. Potatoes, about 8 tons this year, and 7 tons 5 cwt. last year; disease showed itself about the beginning of September, but did not affect more than one-fifth of the crop; a number of new varieties planted, but with little success. Turnip crop, this year about 16 tons, last year about 14 tons; crop brairded well, with the exception of the last sowing, which was blanky on account of extremely dry weather, and the blanks had to be resown later on. Crops not so much destroyed by "grub" or wire-worm as in former years, but caterpillars of various kinds more numerous, especially those of the large white butterfly, which attacked Swedish turnips as well as cabbages. The damage done to the turnip crop, however, was not great. Unless where straw was very short, weeds did not injure the crop more than usual, and green crops were kept cleaner than in former year. The growth of pasture was not so great as it was last year, but the feeding quality was superior. The want of quantity, however, overbalanced the superiority in quality, and the pasture did not maintain the same number of stock in the same condition as it did last year. Hill stock have been healthy and fewer deaths recorded than last year. Every year in this district a large number of blackfaced hoggs die from braxy during the winter. Average death-rate about 4 per score, and this rate threatens to be exceeded this year, an average of 3 out of the 20 having died since September last; cattle healthy. The quality of wool is equal to an average, but the bulk is slightly under.

ARGYLESHIRE (District of Inveraray).—Wheat, none grown in this district. Barley, none grown. Oats, a very good crop generally, except where grown on thin soil on rock, where it was scorched; average yield about 30 to 31 bushels; straw generally short; crops well sowed. Harvest, earlier than usual by a few days; about three weeks earlier than 1888. Rye-grass scarcely an average crop, especially on thin soils; little or no clover grown—say 25 cwt.; well sowed. Meadow hay, rather more productive, particularly on damp soils; but haying begun and carried through earlier than usual, so that in some cases it was not full grown; all well sowed. Potatoes, a splendid crop and scarcely any disease, except among new varieties and early kinds; average diseased not more than 8 per cent; at least 6 tons. Turnips, a splendid crop; quite 18 tons; well grown, firm, and scarcely any finger-and-toe; no second sowing required. No appreciable damage by insects; less than usual. Weather dry and hot, and weeds easily kept down. Pastures, rather better. Stock throve very well, and were quite free from disease. Clip of wool, quite up to average.

DUMBARTONSHIRE.—Wheat, 30 to 34 bushels; quality, average; straw, about 10 cwt. more than last year, but brittle and not best quality; seed, 3 bushels. Barley, very little grown, about 34 to 37 bushels; quality fair; straw, fully more than last year; seed 3 bushels. Oats, on good low land, 42 to 47 bushels; straw, 6 to 8 cwt. above last year; quality fair, on light hill land, 30 to 35 bushels; quality of grain and straw better than last year, but in many instances bulk of straw less; seed, 3½ to 4½ bushels. Harvest, about ten to fourteen days earlier than last year. Hay, 1½ to 2 tons; quality very superior to last year. Meadow hay, crop about one-third heavier than last year. Potatoes, 6 to 8 tons, about 2 to 3 tons above last year; no disease in Earlies; some in late varieties; Champions showing more than formerly; new varieties Bruce and Major much like Magnum, and no disease; good croppers and quality. Turnips, 20 tons, in some places more; one of the finest crops on record; much superior to last year; no resowing; excellent braird. No injury from insects or from weeds. Pastures, quality above average and better than last year; some scorching on light land. Stock throve well. Clip of wool very good; above average.

STIRLINGSHIRE (Western District). — Wheat, none sown. Barley, about 34 bushels; good quality; seed sown, about 3½ bushels. Oats, about 36 bushels, fine quality; not so much straw as last year; all well secured; seed, about 4 bushels. Harvest, commenced 2d September, eighteen days earlier than last year. Hay, about 42 cwt.; not quite so much clover as usual; and secured in fine condition. Meadow hay, a fair crop, fully heavier than last year, and much better quality. Potatoes, a fine crop; 7 to 11 tons good quality; little disease when lifted; but in some instances not keeping well in the pits. Turnips, a fine crop and good quality; average 20 tons. The plants came away fine after they got above ground. Weeds, not so troublesome as last year. Pastures, abundant and of good quality. Stock throve well upon the pasture. Cattle and sheep free from disease. Clip of wool, rather heavier than last year.

STIRLINGSHIRE (Eastern District). — Wheat, 40 bushels, being 10 bushels more than last year; quality very good; straw also heavier than last year, of fine quality; 3 bushels seed sown. Barley, 38 bushels, being 8 bushels more than last year; where it was not early laid, the quality is superior to last year, but a large portion on the better-class land was badly laid, the yield being of indifferent quality; straw is considerably heavier than last year; 3 bushels seed sown. Oats, 50 bushels, being 12 bushels more than last year; quality good; straw heavy, and in many places so badly laid that it necessitated cutting with the scythe, which added materially to the expense of harvesting; 4 bushels seed sown. Harvest began about the 15th August, being five days earlier than usual; owing to wet weather, the time occupied in cutting was very protracted; there was, however, little damage caused by sprouting, and the drying winds which followed enabled farmers in the earlier districts to secure all their crops in excellent condition; in some of the later districts they were not so fortunate. Hay, 40 cwt., about the same quantity as last year; it is well mixed with clover, and secured in exceptionally fine condition, but notwithstanding the superiority of the quality compared with last year's crop, it is realising 20s. per ton less money. Meadow hay, none grown. Potatoes, 9 tons, nearly double last year's crop; fine quality and almost no disease; Sutton's "Abundance" is the only new variety grown, and that only to a small extent. Turnips, 20 tons, double last year's crop, and almost no appearance of finger-and-toe. Pastures were over the average in growth and of average quality. Stock did very well, but owing to the high price of grazing cattle in spring there was little left as profit to the feeder. With the exception of one or two outbreaks of pleuro amongst dairy cows, which were promptly stamped out, there has been little disease amongst live stock. Clip of wool, an average in quantity and quality.

FIFESHIRE (Eastern District).—Wheat, quantity 38 bushels; straw, 1½ ton; quality of grain and straw both much better than last year; seed, 3 bushels. Barley, quantity 38 bushels; straw, 1 ton; quality of grain and straw much better than last year; seed, 3 bushels. Oats, quantity 40 bushels; straw 1¼ ton; quality of grain and straw both better than last year; seed, 4 bushels. Harvest began at usual time, but three weeks earlier than last year. Hay, 1¾ ton; well mixed with clover; quality much better than last year. Meadow hay, about 1½ ton; very little grown in the district. Potatoes, 6 tons; quality good and much better than last year; little disease; no new variety of any importance, except the Bruce which promises to take the place of the Magnum Bonum. Turnips, 16 tons; quality and quantity much better than last year; crop brairded well; no resowing. No injury from insects; no injury from weeds. Pastures very abundant. More stock were kept than in 1888; throve well. Wool was an average clip.

FIFESHIRE (Middle District).—Wheat, this crop will be considerably above an average both as to quantity and quality of grain and weight of straw; it is very much superior to the crop of the previous year; the yield of grain about 34 bushels; weight of straw, 1½ ton; seed used about 3 bushels. Barley, yield about 36 bushels; quality very various, weighing from 53 lb. to 57 lb.; owing to the forcing character of the weather in the early part of summer, this crop especially shot out to a great length, and was very much laid by the rains of July and August, consequently on the best and deepest soils it was inferior in colour and quality; weight of straw, 1⅛ ton; seed about 3 bushels. Oats were an excellent crop; the yield will be about 50 bushels; the quantity of straw may not be greater than in the previous year, but the quality is much better; the weight of straw will be 1¼ ton; seed used about 4 bushels. The harvest was neither late nor early; cutting was generally begun by the 1st September. The weather was all that could be desired for cutting down and securing what may be called an abundant crop. In many cases the crops were in the stackyard in four weeks, and generally harvest operations were concluded within five weeks. The straw of all the cereals is this year of very superior quality. Hay was a very good crop; weight about 2 tons; quality very fine; secured in most cases without a shower; well mixed with clover. Meadow hay, very little in this neighbourhood. Potatoes, about 6 tons; quality excellent; much better yield than last year. There was very little disease, and that only amongst the Regent variety. A comparatively new sort called the Bruce has been planted on not a few farms; it is a late variety, similar in shape to the Magnum, a robust grower and a large cropper, and will be probably a disease-resister. Swedes, 18 tons; yellows 16 tons; quality very good, much better than last year. The above refers to crops on good turnip soils; on heavier soils, sown after the 10th June, the turnips did not braird until the first week of July, and in those cases the crops are much lighter, only about 12 tons; but in this district this class of soil is not common. No second sowing. The crops were not injured by insects. No injury done by weeds. The amount of pasture was over an average, and the quality was superior to that of 1888. Sheep and cattle throve fairly well. Clip of wool good, fully over the average.

FIFESHIRE (Western District).—Wheat, 36 bushels; grain much superior in quality and also in quantity than last year; straw more bulky, and of as good quality, 1½ ton; seed 3 bushels. Barley, 34 bushels; grain average quality and quantity, above last year; straw also average; straw 1 ton; seed 3 to 3½ bushels. Oats, 46 bushels; grain and straw in quality much as last year, quantity of both average and better than last year; 1¼ ton straw. Harvest began ordinary time. All the grain crops on good and well-conditioned land are above average for bulk, but quality damaged where much laid by the heavy rains in July. Hay all over a superior crop, and saved in the finest condition; 1¾ ton. No meadow hay. Potatoes, 6 tons; average quantity, and above average in quality; early sorts, as Regents, showed disease, which extended after lifting; the acreage of Earlies planted is yearly decreasing; later and newer sorts, as "The Bruce" and Sutton's "Main Crop, Kidney," were a fine crop, and of finest quality, and will largely supplant some of the older-fashioned kinds. Turnips, 16 tons; crop over average; quality fine; braird good, except in the later sowings, which brairded irregularly owing to a tack of dry weather at the time; but fine weather following caused very rapid growth; one sowing. No damage by insects. Crops as a rule were not damaged by weeds. Pastures were extremely luxuriant, and far above an average growth. Stock throve well. Cattle and sheep as a rule have been in ordinary health, though there have been, especially amongst cows in some districts, more cases of pleuro-pneumonia. Clip of wool, average.

PERTHSHIRE (South-West District).—Wheat, quality much better than previous crop, and quantity more abundant; natural weight per bushel up to standard weight of 62 lb. on some farms, but not on all; return, 32 bushels; seed 3 to 4 bushels; straw good and plentiful. Barley, a fine crop as regards quantity of both grain and straw; not so well coloured as in '87 for want of sunshine; and this applies to all the cereals; return, 40 bushels; seed, 4 bushels; weight, 54 lb. and upwards. Oats, the largest and best of the grain crops; straw plentiful and good; yield on the threshing-floor large, averaging 45 bushels, and weighing 42 lb. at least; seed 5 bushels. Harvest commenced two weeks sooner than in '88, but protracted for want of good winning weather in the later districts, especially where labourers were scarce. The want of hands is now a common complaint. Crops generally well got. Hay, a very abundant crop, much larger than that of previous season, and quality good. In fact the crop bulked so largely that there is an unusually large quantity on hand, and the price going is lower than it has been for many years. Meadow hay, a very fair yield, and quality quite as good, if not better than usual. Potatoes, the crop was a superabundant one, of good quality, and nearly free of disease; and as a result the price throughout the winter has been unremunerative. Rarely have we seen so many potatoes on hand at this season (February), nor a slower or worse trade. Turnips, a very abundant crop in most places, about 20 tons, where free of finger-and-toe, and it was not common in this district. Crops very free of insect life. Weeds not more than usual; but green crops and fallows might be better cleaned. Pastures better than ordinary, but not so *feeding* as in a sunny dry season; consequently graziers did not realise great profits. Nor have those who finished their cattle at the stake made anything by them. Very well on the whole. Cattle and sheep very free of disease in this district. Clip of wool, quite up to average in quantity and quality.

PERTHSHIRE (District of Coupar-Angus).—Wheat, about 40 bushels; weight, from 63 to 67 lb.; average crop; fully better than last year as to straw; seed, from 3 to 3½ bushels. Barley, 40 to 46 bushels, weighing from 53 to 57 lb.; good bulk of straw; seed from 2 to 3 bushels; suffered in colour, being very much lodged. Oats, 32 to 36 bushels; where early sown on good land, 50 bushels; heavy crop of straw, but very much lodged; weight of grain from 42 to 46 lb. Harvest commenced 17th August, nearly a month earlier than last year. Hay, average crop, about 2 tons. Very little or no meadow hay. Potato crop very varied, from 4 to 10 tons, a good deal being small; generally ¼ more; no disease; no new varieties better than Regents. Turnips, very good crop in general; no damage from insects; no resowing. Fields in general were more injured from weeds than in former years on account of so much wet weather in the earlier part of the season. Pastures were in general above the average of years, and more than average growth. Stock throve not so well as the pasture indicated. Clip of wool, average.

PERTHSHIRE (Western District).—No wheat grown. Very little barley grown. Oats, fully an average, 36 bushels; seed used, 6 bushels. Harvest about ten days sooner. Very little rye-grass grown. Meadow hay fully an average. Potatoes a good crop, with very little disease. Turnips, a very good crop. No injury from insects; no injury from weeds. Pastures much better than last year. Stock throve well. Cattle and sheep have been free from disease. Clip of wool, quality very good, and above the average.

PERTHSHIRE (District of Strathearn).—Wheat, a very small breadth grown; average crop, 34 bushels; 3 bushels sown. Barley, an average crop; 40 bushels, but not very well coloured; 3½ to 4 bushels sown; in heavy land very much laid and twisted, with a considerable quantity of second growth. Oats, above an average crop; 40 to 45 bushels, ripened very unequally, but was well secured; 4 to 5 bushels sown. Harvest was from ten days to a fortnight earlier than last year, with broken weather during commencement and also towards the end; crops on heavy land very much laid, and reaping very tedious and difficult to execute; stooks, for want of drying winds, stood longer than usual in the fields. The hay crop was a very bulky one; above 2 tons on good land, and secured in excellent condition. Meadow hay was also an excellent crop of good quality, well secured, and much more productive than last year. The potato crop was much in excess of last year, being above an average, of excellent quality, and free of disease; 8 to 10 tons. The turnip crop has on the whole turned out an excellent one, although the wet weather in the middle of May retarded the early sowing of Swedes; the braird was rather indifferent in many places, and second sowing had in many cases to be resorted to, with a fair amount of success; weight, 18 to 20, and in some cases 25 tons. There was comparatively little injury to crops by insects, except in occasional cases, from fly on turnip braird; the damage, however, was less than usual. The oat and barley crops, especially after green crop, suffered from wild mustard and other weeds, but not to any great extent. The pastures were good, and stood out well. Stock throve well, and where getting cake, came early into the fat market. Both cattle and sheep kept free of disease, except in one or two exceptional cases, where pleuro-pneumonia broke out. The clip of wool was fully an average one, and of fairly good quality.

PERTHSHIRE (Highland District).—Wheat, none. Barley, 25 bushels; quality and quantity, average; weight, 52 to 55 lb.; 4 bushels are sown. Lea oats, full average of straw; quality good; weight, 41 to 43 lb.; yield 42 to 44 bushels; 5 bushels are sown. Red land oats, better than lea oats. Harvest began about the average time, and the weather very good; all grain crops well secured. Hay, about 22 or 23 cwt.; quality, very good, both as regards rye-grass and clover, particularly rye-grass. Meadow hay, more productive than last year, but not so well harvested. Potatoes, excellent crop, both in quantity and quality; weight, 6 tons; very little disease; no new varieties. Turnip crop above average; better in quantity and quality than last year; weight, 22 tons; the crop brairded well, and there was no second sowing. No destruction by insects; no damage by weeds. Pasture abundant, but not very nutritive. Stock throve fairly well. Native cattle healthy; one case of pleuro on a farm from imported cattle. Clip of wool, very good, above the average in point of quantity and quality.

PERTHSHIRE (Dunkeld and Stormont District).—Wheat, very little sown in this district, only red; average, 22 bushels; straw good; 4 bushels sown. Barley, crop good, mostly common barley; 36 bushels; weight, 54 to 55 lb.; straw good, well secured; colour of grain not so good, for want of sunshine. Oats, crop very good, both for quantity and quality; 44 bushels; weight, 42 to 45 lb.; straw very good, and well secured; on some small portions of land the crop was light, owing to the drought in June month. Harvest began about the usual time, 1st of September. The hay crop was good, and all well secured; 1 ton 10 cwt. Little or no meadow hay. Potatoes good, but not better than last year; 5 tons 10 cwt.; little or no disease; the only new variety, the Bruce by name, offers very well, very like the Magnum. Turnips, very good; weight, 18 tons, but some as high as 30 tons, quality good; the crop brairded well, except some small portions, which were too late, and the drought had taken the moisture out of the soil; they came after the rain, but were too late, and are no crop. No injury done by insects to the turnip crop or barley this year. No injury by weeds; fine season for killing; less injury than usual. The best season for grass we have seen for many years; no frosts in May, nor northerly winds; the grass could not be eaten up. Stock throve very well, and were free from disease. Clip of wool, about an average.

FORFARSHIRE.—Wheat, 34 bushels; quality of grain and straw above the average of last year; 3 bushels sown. Barley, 42 bushels; grain darker in colour than last year; quality of straw above an average, and better than last year; 3½ bushels sown. Oats, 48 bushels; quality of grain and straw rather better than last year; 4½ bushels sown. Harvest about ten days earlier than usual. Hay, 1 ton 14 cwt.; quality very variable; as a rule, quality of rye-grass good, but great deficiency in clover on light soils. No meadow hay. Potatoes, 7 tons; no disease; crop very variable; quality as a rule good, fully an average of that of last year. Turnip crop a particularly good one; average weight, say 21 tons; quality much above that of last year; only one sowing required. The pastures were of fully an average growth, as compared with last year; quality about the same; the aftermath at the beginning of the season was disappointing, but it improved considerably through the autumn. Stock throve very well. Outbreaks of pleuro-pneumonia have been constantly recurring in the county through the season, but at present there are few cases; no other disease of any note. Clip of wool, quality good; about an average.

ABERDEENSHIRE (District of Buchan).—Wheat, not grown. Barley and bere good crop; the yield of each will exceed that last year by nearly 1 quarter; weight about 54 lb.; average, 40 bushels; sown, from 3 to 5 bushels. Oats, fully as good a crop as has been for some years, and proving much better than last year; straw, in excess of last year, and of very fair quality; during the latter part of the harvest, the weather was so damp and wet that a good deal of the crop was carried to the stackyard; the earlier part too soon, the latter part in middling order, of which the straw will not be of so good quality; weight of oats above that of last year; about 40 to 42 lb. sown; from 5 to 6 bushels. Harvest commenced last year about 1st of October, this year about 1st of September, being a month earlier than last year. The hay crop was fully an average; the earlier part was secured in first-rate order without getting any rain; the latter part in not over-good order; fairly mixed with clover; the yield would be from 26 to 35 cwt. Not much meadow hay in the district; the quantity fully an average. The yield of the potato crop is an average one, and of good quality. The turnip crop is, generally, one of the best that has been for a considerable time, especially the yellow crop; the weather during the beginning of the season was suitable, but during the latter end there was rather too much rain for Swedes increasing in growth so much as they would have done in more favourable weather; weight of Swedes, 20 to 25 tons, yellow from 20 to 27 tons, in some cases exceeding that weight. The turnip land was got well prepared, and the braird came away regularly, so that little second sowing was necessary. Very little injury done by insects. In many fields the weeds were well kept down, but some fields show signs that they have not been so well eradicated as they should have been. The pastures generally showed a luxuriant growth, and were very plentiful during the greater part of the season, until the latter part when it was wet and colder. Stock made very good progress, especially during the earlier and drier part of the season. Stock comparatively free from disease this season. Clip of wool, equal to, or if anything in excess of, last year, while the price is much better.

ABERDEENSHIRE (District of Formartine).—Wheat not grown to any extent in this district. Barley and bere much cultivated; this crop was very various; on heavy and good barley land the quantity of straw was fair, but on gravelly or lighter soils the straw was less than last year; owing to the great drought and strong sunshine during the months of May, June, and July, this crop ripened very unequal; on some farms where there were knolls in the field they were scorched and dried up; hence the weight of grain is very various; the weight of grain this year would be more than last year; from 53 to 56 lb.; the quantity also would be over last year, 40 bushels; quantity sown, 4 bushels barley and 3 bushels bere. Oats were not such a bulky crop as last year; but the straw is of much better quality, and the out-turn of grain at least 8 to 10 bushels over last year; the weight per bushel 42 to 44 lbs.; quantity, 40 bushels; during harvest the weather was dry and favourable for reaping, and also for carrying to the stackyard; quantity sown, 5 to 6 bushels. Harvest commenced last year about 2d October; this year on 30th August, and was generally finished by the time harvest was commenced last year. The hay crop was secured in good order, and was an average crop; in some cases the clover plants were deficient; 1½ to 2 tons. No meadow hay. Potatoes, a good crop, and quite an average to former years; disease showed itself amongst the early sorts in the gardens; the field crops were free from disease, and good quality; about 7 to 8 tons. The turnip crop is very various; the early-sown turnips, both Swedish and yellows, are a good crop; the yellows, sown later on owing to the dry and warm weather in June and July, did not braird well for want of moisture in the soil, and where they did braird, they have not come to maturity, producing only leaves and not bulbs; weight of early-sown turnips Swedish, 19 to 24 tons, yellows 16 to 18 tons, the late-sown turnips almost *nil.* Insects injured the late-sown turnips where they did braird, and when about ready to be singled, the leaves of which, in many cases, were riddled and eaten clean up by a small grub. The turnip and potato land was got well cleaned, and during the thinning of the turnip the weeds were easily kept under. The pastures were both early and abundant; during the first part of the season, May and June, it was hardly possible to cut them down, as they grew so fast; by August they commenced to fall away; by the beginning of October, when the autumn rains came, a fresh growth set in, so that pasture grass was abundant the whole season. Cattle and sheep did well on the pastures owing to the abundant grass season and the dry and warm weather. Cattle and sheep have been free from all infectious and contagious diseases in this district, the only complaint being the death of a good few breeding ewes, caused by the luxuriant growth of the grasses in the early part of the season. The clip of wool was a good average.

ABERDEENSHIRE (District of Garioch).—No wheat. Barley: this season was much more favourable for the growth of barley than last year, which increased the yield to 40 bushels, or 10 bushels in excess of last year, whilst the weight is 54 lb., or 4 lb. in excess of last season. The length of straw was similar to last year, and quantity sown 4 to 4½ bushels. Oats: the crops of oats would have been better than last year, had it not been for the excessive drought and heat in the months of June and July, which crippled their growth, and consequently diminished the quantity of straw, but as the crops of last year varied considerably, the average out-turn of grain may show an increase of 2 bushels, making the yield 32 bushels; the quantity used for seed 6 bushels. Harvest was commenced about the 27th August, or about an average date taking a series of years. The crop of hay was somewhat less than last season, but the mixture of grass and clover quite equal; a deal of it, however, was secured in bad order; 1½ ton would be about the weight. No meadow hay. The quantity and quality of the potato crop were much superior to that of last year, but as the area under that crop in the Garioch is so small, general results are thereby little affected; the yield may be written 6 tons; no new variety was planted, and no disease observable. The Garioch Turnip Growing Association report that this year's crop has only been exceeded but twice during the last thirty years, and the weight must be written 6 tons above the average of last year, giving a result of 20 tons. The crop brairded well, and no second sowing required, unless small portions affected by drought, which were late in being prepared. No loss to the crops was sustained by insects, and no injury did the crops suffer from weeds; whilst the pastures afforded a full bite throughout, but notwithstanding cattle made very little progress, and the grazier has been poorly paid; but cattle and sheep have been comparatively free of disease. The clip of wool was about an average.

ABERDEENSHIRE (District of Strathbogie).—No wheat grown. Very little barley grown in this district, but there is a quantity of common bere. Owing to the excessive drought which prevailed during the early portion of summer, the harvest was generally early, and the crop of straw rather short in many cases. Strange to say, the out-turn of grain has been disappointing, and generally less than expected, and the weight has also been lower than expectations. The yield of crop will be about five quarters, and the weight of grain (bere) would vary from 52 to 54 lb. Oats generally have been a splendid crop, plenty of straw of fine quality, and a good yield of grain. The yield of grain will be about five quarters, and the weight from 40 to 43 lb.; the latter weight would be reached by only the finest oats. The harvest began rather before the usual time, perhaps about a week sooner than usual. During the early part of the harvest fine weather was enjoyed, but unfortunately rain came and lasted a while, which retarded leading, and caused considerable damage by heating in many stackyards. The hay crop was very variable as regards bulk, but generally well mixed with clovers among the grasses. The potato crop was remarkably free of disease, and much over an average weight, the quality also being fine. The general average of the crop may be estimated at from 6 to 7 tons. The turnip crop has also been heavy and of fine quality. Owing to pretty dry weather during brairding time, the plants came up rather irregular, and on stiff clay soils the crop has been on the whole somewhat open; but where such has been the case, the bulbs have been large, consequently a heavy crop has been grown. The pastures in Strathbogie generally were very luxuriant last season. In the early part of the summer stock did very well, but observant graziers maintain that from the middle till the end of the season stock made rather slow progress. In this district cattle and sheep have been free of disease and healthy. The clip of wool was good, and perhaps a little over an average in weight.

BANFFSHIRE (Lower District).—Wheat, none. Barley, 38 bushels. Oats, 36 bushels; straw much less than last year, owing to the month of June having been so dry, but there was a good deal of straw left over from last crop. Harvest nearly three weeks earlier than last year; generally speaking, the harvest in the later portions was very tedious and unsatisfactory. Hay, fine quality, but the crop short; average, 11 cwt. Potatoes, good crop, and almost no disease, especially among Champions; average, 3 tons, and quality excellent. Except on clay land the turnip crops were far above an average; Swedes, 26 tons; yellows, 24 tons; very little second sowing required. Pastures short, owing to the long-continued droughts; stock throve well where pasture held out. Wool, slightly above the average.

BANFFSHIRE AND MORAYSHIRE (Upper District).—Wheat, crops variable in quantity; average, fairly high, and quality very good; quantity, about 36 bushels. These remarks refer to the Laigh of Moray; wheat is not grown in Banffshire or upper district of Moray. Barley, quality very good; quantity, about 32 bushels; was rather deficient, most fields having suffered to some extent by scorching. Oats, a good crop on heavy land, but on light and even medium soils the crops were stunted by drought, causing a second growth in most fields, which spoiled the sample by greens; quantity, 36 to 39 bushels. Harvest from eight to fourteen days earlier than usual. Hay, on heavy land where unpastured during winter, there was an average crop of about 120 stones, or 1⅗ ton; but on light soils and where pastured late in spring, the crop was barely half an average. Meadow hay, none grown. Early planted potatoes were a good crop; those late planted suffered from drought and second growth. Turnips, an excellent crop all over; average weight, possibly about 25 tons. No injury by insects or weeds. On dry soils the pastures failed early, but came again in August; on heavy soils and late districts there was a full bite all summer. Stock throve well. Average fleece.

MORAYSHIRE (Lower District).—Wheat was the best crop of the season, both as to grain and straw; the quantity for the lower district of the county would average 38 bushels; and, on account of the very dry season and bright sunshine, the quality was much above the average, some parcels weighing 64 and 65 lb., and of fine bright colour; on account of the great drought in the month of June and July, said to be the most severe since 1868, the quantity of straw was under the average, but of fine quality; seed, 3 to 4 bushels. Barley was much under the average, both as to quantity of straw and grain; for the reason stated, the grain would be on the best heavy soils 5 quarters, but on a large breadth of light soil from 2½ to 3 quarters, some fine examples weighing 58½ lb.; the colour of the grain was not so bright as might have been expected in many cases, thought to be the result of the great heat; the quantity of straw was much under the average, but of fine quality; seed used, from 2½ to 4 bushels. Oats, almost universally a light crop, the result of the want of rain; that grain thrives best in a moist climate, both straw and grain being much under average; the yield on heavy soils, 5 quarters 4 bushels, and on light soils, 2 to 3½; grain, fine in colour, but not so plump as usual; straw would be one-third under average; quantity of seed used, 3 to 4½ bushels. Harvest was fully two weeks earlier than usual, some fields of barley being ready for reaping in the end of July; the weather was very favourable, and with the light crop, fully one-third below the average; as to bulk of straw, the harvest was of short duration, and the whole secured in fine condition. The hay crop, except on moist soils, was much under the average; rye-grass and clover were well mixed and harvested in fine condition; the weight would range from ½ ton to 1½ ton. Little or no meadow hay. Potatoes were an average crop, except on very light sandy soils, where the tubers were rather small, quite free from disease, and of fine quality; the yield would be from 3 to 6 tons. Turnips, an average crop, a little mildewed in the end of August, which to some extent prevented the crop from being so heavy as it would otherwise have been; the crop brairded fairly well in most cases, except on very light soils, which did not braird in not a few cases till the rains in August; weight, from 18 to 26 tons. Little or no injury from insects. The crops did not suffer from weeds more than usual; except in cases where very light, some variety of weeds took possession of the land almost entirely. The pastures during the first part of the season, on account of the great heat, made rapid progress, and were unusually abundant, and stock made very satisfactory progress for a time; but, on account of the extreme heat and want of rain, a large portion of the pastures got quite brown and dry, but the rains in August sweetened them very much; the grazing season was on the whole satisfactory. No disease among cattle or sheep in the county. On account of the very mild winter the clip of wool was fully an average.

NAIRNSHIRE.—Wheat, none. Barley, quantity of grain rather less than last year, but straw much less, say one-fourth; seed sown, 3 to 4 bushels. Oats, grain 6 to 8 bushels less; straw nearly one-half less; quality fair; 5 to 6 bushels sown. Harvest three weeks earlier. Hay, quantity rather over an average, and quality good. Potatoes, yield over an average; very little appearance of disease. Turnips, several tons over last year; crop in general brairded well with a few exceptions; no second sowing required. Not any greater damage by weeds than usual. Pastures, first of season over an average, but later on, owing to dry scorching weather, less. Stock throve fairly.

INVERNESS-SHIRE (District of Inverness).—Breadth of wheat small, but quality good; quantity sown, from 3 to 4 bushels; yield, from 28 to 36 bushels. The quantity and quality of barley grown in excess of former years, and yield would average about 4 bushels more than in 1888; the colour was somewhat dark, but it was plump and sound, and very heavy weights; straw, fair yield. There was a good crop of oats where the soil was heavy, but on light soils the return was less than in 1888; the quality, however, was good; the quantity sown about 4 bushels; yield, from 3½ to 5 quarters. The harvest was earlier than usual by some two weeks, while it was nearly a month earlier than 1888. The quantity of hay grown was about one-third less than 1888, while the quality of rye-grass and clover was excellent; on some heavy lands 2 tons would be grown, but from 25 to 30 cwt. would be an average yield. Meadow hay, none grown. The yield of potatoes was excellent, as well as quality; some 8 to 10 tons was not uncommon, while 7 tons would be an average; there were some new varieties grown, chief among them being the Bruce, which yielded about 12 tons. The weight of turnip crop was equal to crop 1888 in quantity, while the quality is excellent; some fields would average 27 tons, while others would be about 20 and 22, according to soil and manuring; the crop brairded well, except on some heavy clay soils, but little second sowing was resorted to. Less than usual injury by insects. There was no unusual damage done to the crops by weeds. The quantity of grass was about an average, while the quality was better than in 1888. Stock throve fairly well, and were free from disease, with the exception of the outbreak of pleuro-pneumonia among a herd of cows, which was introduced from the south. The clip of wool was very good, being a full average of former years.

INVERNESS-SHIRE (District of Beauly).—Wheat, 28 bushels of fair quality, with plenty of straw. Barley, 32 bushels of fine grain, with a fair amount of straw. Oats, 40 bushels of good grain, and a heavier crop of straw than the preceding year. Harvest began about the first week of August, fully three weeks before the usual time. Hay, 1¼ ton, of fair good quality; little difference from last year. Meadow hay, none in the district. Potatoes, 6 tons of very fine quality; no disease appeared; the Bruce variety was introduced for the first time with good results. Turnips, 20 tons of fine quality; both weight and quality exceeding last season; brairded irregular owing to too hot dry weather at sowing time. Pastures good on heavy soil during the season; on light soils very inferior after the month of June. Stock throve but moderately owing to the oppressive heat during the past grazing months. All classes of stock free from disease in this district. Wool, good quality; rather over than under an average yield.

INVERNESS-SHIRE (Skye).—Wheat, not grown. Barley, not grown. Oats, 2 bushels more than last year, and straw of excellent quality. Harvest began two weeks earlier than usual. Rye-grass and clover generally light. Meadow hay, an average crop. Potatoes, a ton more than last year, and no disease; new varieties were planted, and with excellent results. Turnips had to be sown twice owing to the drought, when not sown early; but nevertheless they have turned out a splendid crop, and are 3 tons above an average. Crop suffered less from weeds than usual this season. Pastures were very much scorched during the summer. Stock did not thrive well till the autumn. The quality of the wool was very good, but light.

INVERNESS-SHIRE (Lochaber).—Wheat, none grown. Barley, almost none grown. Oats, an exceptionally bright and dry summer, and straw very short and grain light; about 24 bushels; 6 bushels seeds. Began harvest about three weeks before usual time, owing to the great heat and bright sun. Hay, about 1 ton; quality good. Meadow hay, less productive. Potatoes, 6 tons or thereby; almost no disease; not aware of any new varieties. Turnip crop very fair; about 22 tons; brairded well here before dry weather set in, and little or no second sowing necessary. Dry season tended much to keep down weeds. Pastures below average, owing to dryness and heat. Stock throve not so well as usual, owing to the poorness of the pastures. Clip of wool under average.

ROSS-SHIRE (Western District).—Wheat, none sown. Barley, little or none sown. Oats, 22 bushels; quality better than last year; seed sown, 6 bushels. Harvest, a fortnight before. Hay, 1 ton, and quality fair. Meadow hay, about the same. Potatoes, yield, about 18 tons; no disease; no new variety sown. Turnips, weight about 20 tons; quality good; brairded well; one sowing only. No injury by insects; no damage by weeds. Pastures, fully average. Stock throve very well. Clip of wool good, and full average.

ROSS-SHIRE (Districts of Dingwall and Munlochy).—Wheat, breadth again larger; quality of grain superior, accounted for by very dry sunny season; quantity full average, say 34 bushels; quantity of straw below average, quality good; seed was large, as last season's growth was so inferior; fully 5 bushels. Barley, quantity more than average, say 40 bushels; quality very fine; quality of straw fine, quantity rather short; seed 3 to 4 bushels. Oats, quality above average; quantity rather below, say 33 bushels; quantity of straw 20 per cent below average, owing to dry weather; quality of straw was fine; seed 3½ to 5 bushels. Harvest began fully ten days earlier. The crop of hay was above average, say 1¾ ton; was easily secured and well got. Clovers were not so luxuriant in growth as previous years. No meadow hay in this district. Yield of potatoes about average; there was no disease; not many new varieties were tried; crop, say 6½ tons. Turnip was in general fine, say 17 tons. The seed brairded nicely, with the exception of the later-sown fields, where freshly worked land got so dry that the seed did not braird till rains came after 16th July. Weeds were not so much trouble nearly. Pastures were very luxuriant early in the season, but the drought was so severe from 10th June to 16th July that they were not of average value. Stock throve well on the whole. Clip of wool, fully average.

Ross-shire (Tain, Cromarty, and Invergordon).—Wheat, 34 bushels; seed, 4 bushels. Barley, 37 bushels; seed, 3 bushels. Oats, 36 bushels; seed, 5 bushels. Harvest, ten days earlier than average. Hay, lighter; 1 ton; want of clover. Meadow hay, none grown. Potatoes, on good land equal to last year; inferior, ⅓ wanted; no disease; Bruce planted, and in every case with good results. Turnips, over average where sown in good time; late, ½ crop; no finger-and-toe. Great quantity of yellow weed. Pastures, below average growth; average quality. Stock throve well, except for six weeks of great drought; rather more than average death in sheep on turnips. Clip of wool, much the same as last year.

Sutherlandshire.—Wheat, not grown. Barley, this crop varies, but, speaking generally for the whole county, it is a light crop with good grain; the bulk of straw does not exceed last year's, but the grain is of better quality and much heavier, and probably fully more of it than last year. Oats, straw is not to wear out well; the bulk was small to begin with; grain good quality, and better weight than last year. Harvest, three to four weeks earlier than last year. Hay, on cultivated land, was a poor crop, being in some cases very much less than last year. Meadow hay, as nearly as possible a failure—it was completely burned up in summer. Potatoes, the weight was better, and no disease, but with few exceptions this crop is not grown for sale to any extent. The turnip crop brairded well, but the dry weather hung it up for a time; afterwards it came on well, and far surpassed expectations; I consider it to be 8 tons above last year. Not any unusual damage by weeds. Pastures, not much behind ordinary seasons; they were burnt up during summer; hill pastures came on afterwards, but did not stand eating. Stock throve fairly on arable land; hill-wedders not dependent on grass-land got into good condition; ewes were only middling; lambs good; hill-sheep have since done well owing to the open winter. A heavy clip, of fair quality and above the average weight.

Caithness-shire.—Wheat, none grown in the county. Little barley grown, bere being a more satisfactory crop; the quantity will be about 33 bushels, and the quality good; weight running from 53 lb. per bushel downwards, depending upon soil and situation. The oat crop may be taken at 33 bushels, and the weight about an average. The season was in some respects remarkable; the temperature in May and June was considerably higher than the average, and the season gave the promise of an abundant and early harvest; but the rainfall was much under the average, and consequently the grain crops were deficient in bulk. Until the middle of July harvest promised to be unusually early, but after that date the weather got colder, with a considerable rainfall; in the end the harvest might be about a week earlier than usual. The prevailing dry weather in May and June was unfavourable for the hay crop; the general weight would not exceed 1 ton, and clover deficient. Little meadow or natural hay grown in the county. Potatoes are not grown as a crop for sale, and the weight has not been tested; but they turned out a very satisfactory crop—probably 2 tons above that of last year; no disease; in quantity and quality they were the most satisfactory crop grown for many years. Turnips: the weather was extremely favourable for the preparation of the ground, and two-thirds of the brake came away very satisfactorily, and turned out an excellent crop; the remaining third is not over half a crop. The ground got so dry that the seed did not vegetate until rain fell; then the plants were attacked by fly in the leaves, and other insects in the bulbs, with the result I have stated. But taken as a whole, the crop may be looked upon as quite an average one, Swedes in particular being a good crop; the whole crop may amount to 16 tons. The damage from insects may be taken as less than usual; wild mustard less abundant than usual, and the same may be said of weeds. In the early part of the summer the pastures were better than last year, but the second growth was checked by want of rain. Live stock throve fairly well. Fortunately the county has been free from disease. It was shut against importations for a great part of the season. Being a breeding county, no imported live stock are required; on the contrary, many cattle are sent out of it—the principal demand being in March and April, and again in September, when a good many stock are taken to the principal districts in Ross-shire and adjoining counties. Prices then ran for the better-class cattle from £13 to £15 each, a paying price at that age. Wool calls for no remark.

ORKNEY.—Wheat, none. Bere is principally grown in Orkney; seed 3½ to 4½ bushels; average crop 1888, 32 bushels 48 lb.; average crop 1889, 36 bushels 49 lb. Oats, seed 4 to 6 bushels; average crop 1888, 24 bushels 36 lb.; average crop 1889, 28 bushels 39 lb. The grain is of first-class quality, but the straw, although also of good quality, is very short in quantity, being about one-third below an average; this is owing to the drought. Harvest began about a week before the usual time, and about a month earlier than last year. Hay, average crop 1888, 1 ton 5 cwt.; average crop 1889, 1 ton 10 cwt. The hay crop was very poor owing to dry weather. Meadow hay, only a little coarse stuff grown. Potatoes, average crop 1888, 7 tons; average crop 1889, 9 tons. Turnips, average crop 1888, 9 tons; average crop 1889, 15 tons; the quality was excellent and no disease, owing to the land being cultivated in a dry state, and to the crop never being too rapidly forced during summer months. The turnip crop was laid down in capital order, and on good finely pulverised soils came very quickly to the hoe, but on clayey or cloddy land a little was sown a second time, and the crop on sandy land was backward and irregular until the autumn, when it improved immensely. Oats, in a few cases injured by grub, but damage much less than usual. Very little weeds, weather too dry for them. Pasture was miserable owing to drought, which, with the exception of two or three heavy showers, lasted from the middle of April to the middle of August. Stock throve wonderfully well considering the bare pastures; this was no doubt owing to the fine warm season, and to the little pasture they had being more nourishing than usual. Clip of wool, average.

Shetland (District of Lerwick).—Wheat, none grown. Barley, straw light, but grain fully as good as last year. Oats, grain and straw both better than last year. Harvest began about three weeks before the usual time. Hay, quality fine, but quantity not equal to last year. Meadow hay, quantity less than last year. Potatoes, better than last year; quality very fine, no disease. Turnips, weight about equal to last year; crop brairded well; only one sowing. Season dry, and pastures not up to an average; considerably worse than last year. Stock did very well. No disease. The quality was good, but the clip was under an average in weight.

THE METEOROLOGY OF 1889.

The following Table gives a comparison of the winds and sunshine of 1889, with the averages of previous years:—

Table showing for Wind Direction and Force, and for Sunshine, the excess above, or the defect from, the averages of previous years.

	Direction of Wind—Days.								Calm.	Force.	Hours of Sunshine.
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.		lbs.p sq.ft.	
January .	−1	−1	0	−1	−1	+1	+2	0	+1	+0.16	− 3
February .	+3	+1	0	−2	−2	−3	+1	+2	0	+0.71	− 7
March . .	0	−1	0	0	−1	0	+1	0	+1	−0.27	−17
April . .	−1	+1	+3	0	−1	−1	0	0	−1	+0.96	−58
May . . .	−2	0	+3	+3	+2	−2	−3	−2	+1	−0.33	−25
June . .	0	+1	0	0	0	0	−1	−1	+1	−0.28	+40
July . . .	+2	+1	+2	0	−2	−4	−2	+2	+1	−0.09	−33
August . .	+1	0	−1	−2	−1	−1	+2	+1	+1	+0.31	−58
September .	+1	0	+1	0	−1	−3	−1	+1	+2	+0.02	−23
October .	0	+2	+3	0	−1	−2	−3	−1	+2	−0.17	−35
November	−1	−1	−2	−2	0	+2	+2	+1	+1	−0.12	−24
December .	−2	−2	−1	−1	+1	+2	+1	−1	+3	+0.14	−20
Year . .	0	+1	+8	−5	−7	−11	−1	+2	+13	+0.09	−263

There was thus an unusual prevalence of calms and east winds, amounting when combined to 21 days, and 23 days deficiency of S.E., S., and S.W. winds. Over the whole of the north-west of the country, temperature was about a degree above the mean of previous years; but on crossing the Grampian range this excess became gradually less, till in the extreme southern and south-eastern districts temperature fell to about the third of a degree below the average. Except in Caithness and the islands to the north, the rainfall was everywhere under the average. The deficiency extended over the whole of the British Islands. At a large number of stations the deficiency was a fourth, and in some cases a third part of the averages of past years. Except in June, there was a deficiency of sunshine, in most of the months strongly marked—the amount during the year being 263 hours, nearly 200 of which falling to the months of April, May, July, August, and September.

JANUARY.—The mean temperature of the month was 39°.5, or 2°.3 above the average, the excess of the days being 2°.6 and of the nights 2°.0. The greatest excess was in the north-west, and at inland stations to the north of the Grampians, being 4°.2 at Lairg and 4°.0 at Inverness; and the least in the south, being only a degree at Pinmore, Ardwell, and Wolfelee.

The rainfall was 2.55 inches, or 1.45 inch under the average. Except in parts of the counties of Argyle, Inverness, Sutherland, and Shetland, the rainfall was under the average, and over large breadths of the country in a large degree, only about a fourth part of the usual rainfall of February being in many places recorded. The greatest defect from the average was 84 per cent in Cromarty, and the greatest excess above it 45 per cent in Islay.

FEBRUARY.—The mean temperature was 36°.8, or 1°.5 below the average, the days being 1°.0 and the nights 2°.0 colder than usual. The greatest defect was about 3°.0 in Shetland, and the least about 0°.5 in Islay. This cold was due to a large increase of northerly winds, and decrease of wind from the south; and this again in its turn was the inevitable consequence of the continuance of a higher barometric pressure in the west than in the east of the country.

The rainfall was 2.92 inches, being 0.18 inch under the average. Its distribution was, however, unequal and remarkable. To the north of a line drawn from Ardnamurchan to Aberdeen, the rainfall was above the average, at several places very greatly so; but to the south of it, the rainfall was deficient. The excess was, in per cent, 165 at Thurso, 110 at Wick, and 106 at Logie-Coldstone. On the other hand, less than the average was registered at Cupar, Perth, Edinburgh, Dumfries, and several other places. It is interesting to note the shelter afforded from the cold rains of these northerly winds by the Grampians to all places to southwards.

MARCH.—The temperature was 39°.6, being the average of the month. It was under the average in Shetland, Orkney, the east seaboard from Kinnaird Head southward, and the whole of the southern counties from south of a line drawn from East Lothian to Arran, the deficiency in the extreme north and extreme south being about a degree. In other parts of Scotland, temperature was above the average, the excess at several places in the west being about a degree.

The rainfall was 2.32 inches, or 0.53 inch less than the average. It was above the mean in the counties of Berwick, Roxburgh, and parts of Aberdeen, Orkney, Shetland, Sutherland, Ross, and Inverness, the excess at the Stour Lighthouse being 70 per cent. Elsewhere the rainfall was under the average, less than half the usual rainfall of March being collected at many inland stations from Glasgow to Braemar.

April.—The mean temperature was 42°.8, or 1°.5 less than the average, the deficiency being nearly equally divided between the days and the nights. The deficiency was half a degree in the north and north-west, but in the south-east, where it was greatest, it exceeded two degrees. The cold weather was occasioned by an excess of easterly winds, being the result of a higher atmospheric pressure in the north than in the south.

The rainfall was 3.01 inches, being 0.78 inch above the mean, but the distribution over the country was unequal. It was above the average over the whole of the eastern slope of the country, or over those districts exposed to the easterly winds; and as there was a southerly element in the east winds of the month, the largest amounts were collected among the south-east facing slopes of the counties of Perth, Forfar, Kincardine, and Aberdeen, where at several stations more than double the average of the month fell. The highest excess was 145 per cent at Perth. Over western districts the rainfall was under the average.

May.—The mean temperature was 53°.1, or 4°.2 above the mean, the days and the nights sharing equally in this high temperature. The excess was greatest in the midland districts, reaching to 6°.2 at Glencarron,—being very high also over the mainland districts of Ross, Inverness, and Argyle, or those districts before reaching which the prevailing south-easterly winds blew farthest over a land surface. But on the other hand, on the east coast which received the easterly winds direct from the sea, the excess was only a degree and a half at St Abbs, Isle of May, Bell Rock, Aberdeen, and Buchanness. Since 1764 observations have been made with thermometers, either at Gordon Castle or somewhere in the north-east of Scotland. In May 1889 the temperature at Gordon Castle was 5°.1 above the mean—a mean temperature only once exceeded during these 126 years—the temperature of May 1833 being 5°.6 above the mean. In May 1889 there occurred an unwonted prevalence of south-easterly winds and deficiency of north-westerly winds, being the result of a great depression of the barometer in the west as compared with the east, the usual difference being 0.010 inch, whereas in 1889 it amounted to 0.080 inch.

Over the whole of the British Islands, temperature was much in excess of the mean, except in the south of Ireland and extreme south-west of Wales, where it was fully a degree under the average.

The rainfall was 2.24 inches, being very nearly the average. Everywhere to the north of the Grampians it was under the average, as also in the counties of Kincardine, Forfar, and parts of Peebles, Selkirk, Roxburgh, Dumfries, and Argyle; but elsewhere it was in excess of the average. The great excess occurred from Paisley eastward to the Pentlands, and northwards to Loch Tay; and in Galloway, where at several places it rose to 70 per cent above the average. A deficiency of from 60 to 80 per cent was very general to the north of the Grampians.

JUNE.—The mean temperature was 57°.1, or 2°.3 above the average, the days being 3°.8, but the nights only 0°.8 above the average. The high temperature was thus chiefly due to the strong sunshine which prevailed. The excess was somewhat larger at inland than at sea-coast stations, but otherwise it was pretty equal over the country. In view of the cold weather which has characterised the growing months of the year for upwards of twenty years, this May and June stand out as marked by their high temperature; indeed we must go back as far as 1868 for two consecutive growing months whose temperature shows an excess over the average of 2°.0. It may be remarked that at Ben Nevis Observatory, May 1889 was 8°.1 and June 6°.5 above the average.

The rainfall was 0.99 inch, or an inch and a half under the average. At all stations it was greatly under the mean, the greatest deficiency being in the north-west, where in some places it exceeded 90 per cent. June was therefore an exceptionally dry and warm month.

JULY.—The mean temperature was 55°.9, or 1°.6 under the mean, the days being 1°.0 and the nights 2°.2 colder than the average. The distribution of temperature over the country was unusually irregular for a summer month. Along the east coast from Tarbetness southward the depression of temperature even exceeded 2°.0, falling at a few places to 2°.5 below the mean. On the other hand, over a large district of the west —bounded by a line drawn from South Uist round Skye, and thence by Dalnaspidal and Rothesay to the Rhinns of Islay— temperature was above the average, in some places as much as fully half a degree. In this latter district the higher temperature was accompanied with clearer skies and more sunshine.

The rainfall was 2.82 inches, or 0.33 inch less than the average. It was above the average along the east coast from the mouth of the Spey southward, and besides over all districts to the south of a line drawn from Edinburgh to the head of Luce Bay. Some very heavy individual falls are recorded; of these the most noteworthy was at Drumlanrig on the 10th, when, from 11 A.M. to 5 P.M., 4.00 inches fell, the greater part of which fell in two hours. At many western stations only a fourth part of the usual rainfall of July was collected.

AUGUST.—The mean temperature was 55°.9, or 0°.9 under the average, the days being 1°.6 and the nights 0°.2 colder than usual. The deficiency of sunshine was 58 hours, resulting in a depressed day temperature during this agriculturally important month. The depression of temperature was greatest in the south-west, and least in the north-east. The general deficiency at southern and western stations was 1°.5; but round the shores of the Moray Firth, temperature was near the average, rising in some districts even a little above it, thus placing this important agricultural district at considerable advantage during August.

The rainfall was 5.40 inches, or 2.03 inches above the mean. From the Lammermoors to the Grampians more than double the average fell at a number of places; and from Wick northward through Orkney and Shetland, the rainfall of the month was equally heavy. The rainfalls of the 5th, 8-9th, 16th, and 19th were exceptionally heavy. At Dundee harbour on the 8th, during the three-quarters of an hour from 2.30 to 3.15 P.M., there fell 1.61 inch, and much damage was done by flooding. On the other hand, it was only about the average at places in and surrounding Skye, about Arran in the Firth of Clyde, and the upper districts of Galloway. Round the Moray Firth where temperature was highest, the rainfall was relatively considerably less than elsewhere at eastern stations. The deficiency of the rainfall over the catchment of the Caledonian Canal was so great that for several weeks during the summer the steamers could not ply from Fort Augustus to beyond Loch Oich.

SEPTEMBER.—The mean temperature was 52°.1, or 0°.8 less than the average, the days being 0°.6 and the nights 1°.1 colder than usual. The greatest depression of temperature occurred in the east from Montrose to Berwick, the deficiency in Berwickshire being 2°.0. On the other hand, in Ayr and Galloway, and also in Skye and round by Gordon Castle and Dalnaspidal to Roshven, temperature was nearly the mean, and at several places slightly above it.

The rainfall was 1.70 inch, or 1.97 inch under the average, being thus less than half the mean of the month. Everywhere it was under the average, the deficiency being most marked south of the Caledonian Canal, particularly in inland situations, where over large breadths less than the fourth part of the average was collected.

OCTOBER.—The mean temperature was 45°.6, or 1°.0 less than the average, the days being 0°.8 and the nights 1°.3 colder than usual. Its distribution over the country was peculiar. Over the Hebrides, Shetland, Orkney, and the east seaboard as far south as Buchanness, it was above the mean. The excess in Shetland was about 2°.5; but in the south of the Hebrides and Aberdeenshire it was only a few tenths of a degree above the mean. In all other parts of Scotland temperature was under the average, the deficiency increasing on proceeding southwards, where it was about 2°.0. At Lerwick, temperature was 2°.3 above the mean of October, but at Corsewall 2°.4 below it.

The rainfall was 3.99 inches, being the average of the month. Its distribution was very unequal. At all eastern stations south of the Firth of Forth the month was a very wet one, the rainfall being in some cases more than double the average, and in all cases at least a half more. It is a singular circumstance that in this section of Scotland October has in recent years been so frequently an exceptionally wet and backward month. The rainfall also was above the average in parts of Galloway, and of the counties of Forfar, Aberdeen, Nairn, Ross, Caithness, and Shetland. Elsewhere it was under the mean, the month being a dry one over large parts of the counties of Ross, Inverness, and Argyle.

NOVEMBER.—The mean temperature was 43°.1, or 2°.7 above the average, the days and the nights being nearly equally above the average. Over the whole of the British Islands temperature was above the mean, the largest excess being about 4°.0 in the north-western half of Scotland, and the least about 1°.0 in the extreme south-east of England, and the extreme south-west of Ireland.

The rainfall was 2.11 inches, or 1.69 inch less than the average. At no station did the rainfall reach the average of the month. The deficiency was markedly greatest in all eastern districts to the south of the Grampians, where nearly everywhere the rainfall did not exceed the fourth part of the average.

DECEMBER.—The mean temperature was 39°.0, or 1°.0 above the mean, the days being 1°.4 and the nights 0°.7 warmer than usual. The excess was greatest in the extreme west, reaching in some places 2°.0. Generally to the north of the Grampians the excess was about 1°.5, but south of this range of mountains temperature gradually fell to the average about the Firth of Forth and the Leadhills, while farther south temperature fell along the Solway Firth and the Borders to half a degree below the mean; and in Central England the depression of temperature was fully 2°.0. In Ireland everywhere temperature was above the mean.

The rainfall was 3.39 inches, being 0.65 inch under the average. In Ayrshire, Argyleshire, West Inverness, the Hebrides, and Shetland, the rainfall was above the mean, the excess in no case exceeding a third part of the average. Elsewhere it was under the mean—the greatest, about half the average, being, as in the previous month, in eastern districts between the Grampians and the Tweed.

The harvest of 1889 was, on the whole, near the average time of the commencement of cutting, but from two to four weeks earlier than in 1888. It was relatively earliest in strictly eastern districts.

Except in parts of Galloway, the wheat crop was a good average generally over the country. Barley was also the average or above it, except in some districts in the north, where it never recovered from the effects of the protracted droughts of spring and early summer. In districts lying between the Firth of Forth and the Grampians much loss was sustained by the rains and dull cloudy weather laying the crops and discolouring the grain. Oats were a fine crop generally, excepting several districts to the north of the Grampians, where the crop suffered from the drought of the early part of the season; straw being in these districts very light.

Potatoes were a remarkably good crop, and, with the exception of some districts between the Forth and the Tweed, the crop may be regarded as free from disease. In nearly every case where disease was reported, it occurred in the pits, and the loss thereby was comparatively trivial in amount. Turnips were on the whole the best crop of the season, being in almost all instances exceptionally good, and the sowing season was unusually favourable, so that second sowings were very rare.

[TABLES.

AGRICULTURAL STATISTICS OF SCOTLAND.—RETURNED UPON 4TH JUNE 1889.—(*Extracted from the Government Returns.*)

TABLE No. 1.—TOTAL ACREAGE UNDER EACH KIND OF CROP, BARE FALLOW, AND GRASS, IN EACH COUNTY OF SCOTLAND.

COUNTIES.	Total Acreage under Crops, Bare Fallow, and Grass.	CORN CROPS.							GREEN CROPS.							Clover, Sainfoin, and Grasses under Rotation.	Permanent Pasture (exclusive of Mountain Land).	Flax.	Small Fruit.	Bare Fallow or Uncropped Arable Land.
		Wheat.	Barley or Bere.	Oats.	Rye.	Beans.	Peas.	Total.	Potatoes.	Turnips.	Mangold.	Carrots.	Cabbage, Kohl-Rabi, and Rape.	Vetches, &c.	Total.					
	Acres.	Acres	Acres.	Acres.	Acres	Acres.	Acres.	Acres.	Acres.	Acres.	Acres	Acres.	Acres.	Acres.	Acres.	Acres	Acres.	Acres.	Acres.	Acres.
1. Aberdeen . .	614,126	29	17,091	194,823	323	291	451	213,008	7,729	91,048	5	64	73	2,763	101,682	268,191	30,224	10	306	705
2. Argyle . .	132,256	..	1,798	19,476	402	133	7	21,816	5,970	5,414	49	40	121	35	11,629	27,019	71,232	..	12	548
3. Ayr . . .	318,369	2,649	1,757	48,415	332	841	6	54,000	8,698	7,607	453	397	429	106	17,690	136,497	109,917	..	106	159
4. Banff . . .	172,435	152	8,136	54,449	162	141	67	63,107	2,490	25,038	3	12	8	1,070	28,621	68,819	11,563	2	25	298
5. Berwick . .	197,363	2,847	19,970	35,816	63	1,177	190	60,063	2,415	28,563	72	3	407	1,001	32,461	60,311	44,400	..	14	114
6. Bute . . .	25,457	..	73	5,241	53	63	10	5,440	1,095	1,401	2	2	15	37	2,552	9,144	8,075	..	37	209
7. Caithness . .	108,545	2	1,552	34,467	73	3	31	36,128	1,879	14,415	..	1	58	502	16,855	31,444	23,750	..	7	361
8. Clackmannan .	15,812	395	552	3,424	18	642	..	5,031	376	751	4	..	14	27	1,172	5,104	4,121	..	16	368
9. Dumbarton .	48,373	971	266	7,128	45	220	19	8,649	2,286	1,464	18	9	161	73	4,011	17,447	18,016	..	54	196
10. Dumfries . .	247,488	120	565	48,081	62	21	2	48,851	5,250	19,898	58	42	534	125	25,907	72,415	100,047	1	52	215
11. Edinburgh . .	139,634	4,053	6,873	23,406	28	228	73	34,661	5,799	11,699	14	26	527	1,064	19,129	37,844	47,503	..	208	289
12. Elgin . . .	102,840	2,497	12,918	22,709	891	56	9	39,080	2,154	16,310	6	9	20	412	18,911	39,568	5,142	..	15	124
13. Fife . . .	253,741	10,593	24,782	39,507	1,768	1,119	26	77,795	16,822	25,919	18	14	218	1,019	44,010	71,976	58,325	20	75	1,540
14. Forfar . .	253,828	8,651	28,663	50,505	1,266	676	46	89,807	15,760	33,337	9	59	95	816	50,076	86,951	26,660	12	127	195
15. Haddington .	115,400	6,998	14,743	16,904	30	1,171	73	39,919	8,085	15,866	92	199	320	448	25,010	31,035	18,829	..	381	226
16. Inverness . .	151,161	62	7,841	31,356	777	2	33	40,071	7,482	11,253	2	..	14	213	18,964	32,506	58,783	2	27	808
17. Kincardine .	122,902	526	10,874	30,884	85	505	63	42,937	3,240	17,842	..	33	11	567	21,693	47,397	10,616	..	96	163
18. Kinross . .	32,286	20	562	5,477	49	7	..	6,115	722	2,325	..	3	56	46	3,152	11,085	11,895	..	2	37
19. Kirkcudbright .	185,975	98	51	29,388	32	93	4	29,666	2,236	13,791	40	44	1,085	33	17,229	67,155	71,676	7	28	214
20. Lanark . .	258,054	2,437	310	39,931	109	958	26	43,771	5,712	8,904	19	52	1,169	751	16,607	106,166	89,467	..	1,542	501
21. Linlithgow .	59,347	1,255	3,033	10,190	30	465	7	14,980	1,858	3,808	5	4	137	277	6,089	19,760	18,120	..	19	379
22. Nairn . . .	27,759	35	2,908	5,741	263	..	18	8,965	421	4,044	..	..	..	51	4,516	9,792	2,467	..	1	18
23. Orkney . .	111,187	..	5,607	32,341	..	..	38	37,986	3,005	14,265	..	..	51	328	17,649	32,807	21,686	..	..	1,059
24. Shetland . .	59,403	..	2,057	7,492	1	..	..	9,550	3,284	1,252	..	1	446	1	4,984	933	43,033	..	1	902
25. Peebles . .	42,726	5	572	8,655	..	2	17	9,251	588	4,381	..	..	481	117	5,567	12,576	15,270	..	2	60
26. Perth . . .	349,268	6,972	16,871	68,478	751	2,428	47	95,547	16,512	29,098	9	15	188	507	46,329	116,660	87,706	7	578	2,441
27. Renfrew . .	96,092	1,986	211	12,778	34	405	5	15,419	3,584	2,225	26	20	296	121	6,272	29,747	44,320	..	69	265
28. Ross & Cromarty	136,954	1,939	12,525	31,671	1,004	20	28	46,587	9,636	16,141	10	3	11	680	26,482	40,909	22,290	..	6	680
29. Roxburgh . .	185,726	642	13,407	32,343	10	320	70	46,792	1,712	24,399	9	3	627	433	27,183	58,270	53,379	1	45	56
30. Selkirk . .	24,152	2	279	4,227	..	..	22	4,530	252	2,350	..	1	221	48	2,872	7,186	9,516	..	13	35
31. Stirling . .	117,877	2,329	3,727	18,733	60	2,687	9	27,545	3,870	4,242	6	6	150	302	8,576	36,273	43,757	15	52	1,659
32. Sutherland .	31,168	..	1,965	7,565	109	..	12	9,651	1,844	2,982	12	..	8	23	4,869	7,973	8,314	..	1	360
33. Wigtown . .	152,721	1,121	929	34,714	47	266	5	37,082	1,980	15,922	160	113	221	126	18,522	70,821	25,773	3	12	508
Total . .	4,888,425	59,386	223,468	1,015,715	8,877	14,940	1,414	1,323,800	154,746	477,955	1,101	1,175	8,172	14,122	657,271	1,671,781	1,215,872	80	3,929	15,692

TABLE No. 2.—ESTIMATED TOTAL PRODUCTION OF WHEAT, BARLEY, AND OATS in 1889, ACREAGE under these Crops, Estimated Average YIELD per Acre, and Estimated Yield per Acre ABOVE or BELOW an Ordinary Average Crop, in each of the COUNTIES of SCOTLAND.

COUNTIES.	WHEAT.						BARLEY INCLUDING BERE.						OATS.					
	Total Produce in 1889.	Acreage in 1889.	Average Yield per Acre.				Total Produce in 1889.	Acreage in 1889.	Average Yield per Acre.				Total Produce in 1889.	Acreage in 1889.	Average Yield per Acre.			
			1889.	Ordinary Average.*	1889 compared with Ordinary Average.				1889.	Ordinary Average.*	1889 compared with Ordinary Average.				1889.	Ordinary Average.*	1889 compared with Ordinary Average.	
					Above.	Below					Above.	Below.					Above.	Below.
	Bush.	Acres.	Bush.	Bush	Bush.	Bush.	Bush.	Acres.	Bush.	Bush.	Bush.	Bush.	Bush.	Acres.	Bush.	Bush.	Bush.	Bush.
Aberdeen	978	29	33.72	36.92	..	3.20	557,444	17,091	32.62	32.41	0.21	..	6,581,613	194,823	33.78	33.05	0.73	..
Argyle	..	..	..	..	..	..	52,683	1,798	29.30	37.52	..	8.22	597,673	19,476	30.69	32.96	..	2.27
Ayr	111,368	2,649	42.04	31.89	10.15	..	66,463	1,757	37.83	40.34	..	2.51	2,242,879	48,415	46.33	46.29	0.04	..
Banff	5,258	152	34.59	35.77	.	1.18	283,803	8,136	34.88	35.43	..	0.55	1,872,793	54,449	34.40	32.70	1.70	..
Berwick	92,903	2,847	32.63	30.34	2.29	..	696,854	19,970	34.90	36.32	..	1.42	1,450,235	35,816	40.49	39.56	0.93	..
Bute	..	..	..	..	..	..	3,166	73	43.37	34.11	9.26	..	229,811	5,241	43.85	31.12	12.73	..
Caithness	52	2	26.00	21.14	4.86	..	53,459	1,552	34.45	29.96	4.49	..	1,195,859	34,467	34.70	30.73	3.97	..
Clackmannan	14,749	395	37.34	30.85	6.49	..	19,871	552	36.00	33.50	2.50	..	149,229	3,424	43.58	33.74	9.84	..
Dumbarton	41,445	971	42.68	30.72	11.96	..	8,897	266	33.45	33.21	0.24	..	285,317	7,128	40.03	35.66	4.37	..
Dumfries	4,177	120	34.81	33.56	1.25	..	20,837	565	36.88	36.16	0.72	..	1,860,816	48,081	38.70	35.76	2.94	..
Edinburgh	168,316	4,053	41.53	36.71	4.82	..	293,039	6,873	42.64	39.60	3.04	..	944,978	23,406	40.37	39.75	0.62	..
Elgin or Moray	83,194	2,497	33.32	30.99	2.33	..	376,924	12,918	29.18	35.48	..	6.30	695,246	22,709	30.62	35.09	..	4.47
Fife	369,184	10,593	34.85	30.16	4.69	..	900,449	24,782	36.33	34.00	2.33	..	1,592,603	39,507	40.31	36.87	3.44	..
Forfar	281,300	8,651	32.52	33.45	..	0.93	1,081,811	28,663	37.74	35.26	2.48	..	2,309,104	50,505	45.72	40.70	5.02	..
Haddington	276,510	6,998	39.51	35.16	4.35	..	620,831	14,743	42.11	40.64	1.47	..	725,013	16,904	42.89	44.44	..	1.55
Inverness	1,984	62	32.00	26.00	6.00	..	239,156	7,841	30.50	30.95	..	0.45	895,629	31,356	28.56	29.81	..	1.25
Kincardine	18,316	526	34.82	34.12	0.70	..	369,959	10,874	34.02	32.16	1.86	..	1,185,672	30,884	38.39	35.86	2.53	..
Kinross	560	20	28.00	28.85	..	0.85	22,831	562	40.62	29.82	10.80	..	217,784	5,477	39.76	32.13	7.63	..
Kirkcudbright	2,875	98	29.34	33.31	..	3.97	1,599	51	31.35	31.92	..	0.57	1,040,250	29,388	35.40	34.23	1.17	..
Lanark	97,216	2,437	39.89	35.95	3.94	..	12,702	310	40.97	34.21	6.76	..	1,511,328	39,931	37.85	35.03	2.82	..
Linlithgow	46,779	1,255	37.27	34.71	2.56	..	126,787	3,033	41.80	42.65	..	0.85	430,758	10,190	42.27	42.13	0.14	..
Nairn	923	35	26.37	—	—	—	85,557	2,908	29.42	34.81	..	5.39	171,625	5,741	29.89	35.25	..	5.36
Orkney	..	..	..	..	..	..	141,211	5,607	25.18	36.13	..	10.95	852,499	32,341	26.36	34.42	..	8.06
Peebles	150	5	30.00	—	—	—	20,432	572	35.72	31.28	4.44	..	298,205	8,655	34.45	34.02	0.43	..
Perth	280,767	6,972	40.27	33.80	6.47	..	625,131	16,871	37.05	34.13	2.92	..	2,513,817	68,478	36.71	36.30	0.41	..
Renfrew	94,834	1,986	47.75	33.64	14.11	..	9,679	211	45.87	37.57	8.30	..	573,575	12,778	44.89	42.09	2.80	..
Ross and Cromarty	61,084	1,939	31.50	34.34	..	2.84	404,310	12,525	32.28	31.95	0.33	..	995,638	31,071	32.04	36.17	.	4.13
Roxburgh	22,635	642	35.26	30.77	4.49	..	469,776	13,407	35.04	35.51	..	0.47	1,269,014	32,343	39.24	37.02	2.22	..
Selkirk	48	2	24.00	26.00	..	2.00	8,370	279	30.00	29.11	0.89	..	145,244	4,227	34.36	29.67	4.69	.
Shetland	..	..	..	..	..	..	50,735	2,057	24.66	20.47	4.19	..	121,573	7,492	16.23	20.29	..	4.06
Stirling	80,194	2,329	34.43	30.17	4.26	.	134,731	3,727	36.15	31.32	4.83	..	740,529	18,733	39.53	31.95	7.58	..
Sutherland	..	..	..	..	..	..	53,265	1,965	27.11	30.33	..	3.22	231,441	7,565	30.59	36.96	..	6.37
Wigtown	36,043	1,121	32.15	30.11	2.04	..	29,272	929	31.51	30.57	0.94	..	1,254,303	34,714	36.13	36.42	..	0.29
Total	2,193,842	59,386	36.94	..	..	..	7,842,034	223,468	35.09	..	..	..	37,182,053	1,015,715	36.61	..	..	..

* As computed from Returns furnished by Estimators in 1885.

TABLE No. 3.—ESTIMATED TOTAL PRODUCTION OF BEANS, PEAS, AND POTATOES in the Year 1889, ACREAGE under these Crops, Estimated Average YIELD per Acre, and Estimated Yield per Acre ABOVE or BELOW an Ordinary Average Crop in each of the COUNTIES of SCOTLAND.

COUNTIES.	BEANS.						PEAS.						POTATOES.					
	Total Produce in 1889.	Acreage in 1889.	Average Yield per Acre.				Total Produce in 1889.	Acreage in 1889.	Average Yield per Acre.				Total Produce in 1889.	Acreage in 1889.	Average Yield per Acre.			
			1889.	Ordinary Average.*	1889 Compared with Ordinary Average.				1889.	Ordinary Average.*	1889 Compared with Ordinary Average.				1889.	Ordinary Average.*	1889 Compared with Ordinary Average.	
					Above.	Below.					Above.	Below.					Above.	Below.
	Bush.	Acres.	Bush.	Bush.	Bush.	Bush.	Bush.	Acres.	Bush.	Bush.	Bush	Bush.	Tons.	Acres.	Tons.	Tons.	Tons.	Tons.
Aberdeen	8,590	291	29.52	28.26	1.26	..	10,560	451	23.41	23.27	0.14	..	44,962	7,729	5.82	5.40	0.42	..
Argyle	3,280	133	24.66	35.13	..	10.47	146	7	20.86	37.62	..	16.76	38,699	5,970	6.48	5.47	1.01	..
Ayr	27,413	841	32.60	34.47	..	1.87	299	6	49 83	34.96	14 87	..	59,331	8,698	6.82	7.03	..	0.21
Banff	4,450	141	31.56	27.29	4.27	..	1,700	67	25.37	23.02	2.35	..	14,316	2,490	5.75	4.62	1.13	..
Berwick	38,251	1,177	32.50	33.91	..	1.41	4,990	190	26.26	24.75	1.51	..	14,669	2,415	6.07	5.92	0.15	..
Bute	1,776	63	28.19	30.96	..	2.77	222	10	22.20	27.83	..	5.63	11,232	1,095	10.26	6.41	3.85	..
Caithness	63	3	21.00	—	—	—	694	31	22.39	—	—	—	12,608	1,879	6.71	5.52	1.19	..
Clackmannan	24,909	642	38.80	26.97	11.83	..	..	..	..	..	..	..	2,377	376	6.32	5.43	0.89	..
Dumbarton	5,898	220	26.81	27.74	..	0.93	447	19	23.53	27.24	..	3.71	19,427	2,286	8.50	6.70	1.80	..
Dumfries	642	21	30.57	29.97	0.60	..	56	2	28.00	33.73	..	5.73	37,126	5,250	7.07	6.24	0.83	..
Edinburgh	6,924	228	30.37	35.58	..	5.21	1,657	73	22 70	27.51	..	4.81	43,313	5,799	7.47	5.89	1.58	..
Elgin or Moray	1,219	56	21.77	31.93	..	10.16	143	9	15.89	22.06	..	6.17	10,579	2,154	4.91	3.99	0.92	..
Fife	43,119	1,119	38.53	34.45	4.08	..	782	26	30 08	30.12	..	0.04	92,773	16,822	5.51	4.45	1.06	..
Forfar	23,898	676	35.35	33.85	1.50	..	1,288	46	28.00	25.97	2.03	..	102,949	15,760	6.53	5.74	0.79	..
Haddington	36,787	1,171	31.42	33.54	..	2.12	1,729	73	23.68	25.89	..	2.21	56,176	8,085	6.95	6.39	0.56	..
Inverness	40	2	20.00	35.50	..	15.50	882	33	26.73	27.31	..	0.58	42,477	7,482	5.68	4.90	0.78	..
Kincardine	18,538	505	36.71	31.33	5.38	..	1,960	63	31.11	24.00	7.11	..	21,805	3,240	6.73	6.46	0.27	..
Kinross	210	7	30.00	23.00	7.00	..	..	..	..	..	..	..	4,347	722	6.02	5.90	0.12	..
Kirkcudbright	3,182	93	34.22	31.26	2.96	..	138	4	34.50	31.00	3.50	..	15,973	2,236	7.14	6.10	1.04	..
Lanark	32,944	958	34.39	33.60	0.79	..	733	26	28.19	26.00	2.19	..	46,968	5,712	8.22	6.52	1.70	..
Linlithgow	14,550	465	31.29	34.07	..	2.78	165	7	23.57	—	—	—	11,960	1,858	6.44	4.95	1.49	..
Nairn	..	..	..	28.00	—	—	312	18	17.33	12.44	4.89	..	2,388	421	5.67	5.09	0.58	..
Orkney	..	..	..	..	..	..	403	38	10.61	—	—	—	19,188	3,005	6.38	7.54	..	1.16
Peebles	70	2	35.00	30.00	5.00	..	404	17	23.76	27.39	..	3.63	4,393	588	7.47	5.82	1.65	..
Perth	88,073	2,428	36 27	28.12	8.15	..	1,291	47	27.47	24.76	2.71	..	100,213	16,512	6.07	5.55	0.52	..
Renfrew	16,916	405	41.77	40.15	1.62	..	211	5	42.20	36 00	6.20	..	31,516	3,584	8.79	7.24	1.55	..
Ross and Cromarty	508	20	25.40	23.42	1.98	..	668	28	23.86	21.71	2.15	..	66,248	9,636	6.88	6.55	0.33	..
Roxburgh	10,540	320	32.94	33.03	..	0.09	1,987	70	28.39	24.96	3.43	..	10,775	1,712	6.29	5.78	0.51	..
Selkirk	..	..	..	..	..	..	550	22	25.00	24.00	1.00	..	1,520	252	6.03	5.13	0.90	..
Shetland	..	..	..	..	..	..	..	..	..	..	..	..	21,562	3,284	6.57	6.16	0.41	..
Stirling	89,593	2,687	33.34	28.96	4.38	..	338	9	37.56	22.04	15.52	..	28,126	3,870	7.27	5.60	1.67	..
Sutherland	..	..	..	..	..	..	233	12	19.42	—	—	—	10,142	1,844	5.50	5.00	0.50	..
Wigtown	7,105	266	26.71	27.96	..	1.25	150	5	30.00	26.33	3.67	..	12,460	1,980	6.29	6.98	..	0.69
Total	509,488	14,940	34.10	..	..	..	35,138	1,414	24.85	..	..	..	1,012,598	154,746	6.54	..	..	..

* As computed from Returns furnished by Estimators in 1885.

TABLE No. 4.—ESTIMATED TOTAL PRODUCTION of TURNIPS and MANGOLDS in the Year 1889, ACREAGE under these CROPS, Estimated Average YIELD per Acre, and Estimated YIELD per Acre ABOVE or BELOW an Ordinary Average Crop in each of the COUNTIES of SCOTLAND.

COUNTIES.	TURNIPS.						MANGOLDS.					
	Total Produce in 1889.	Acreage in 1889.	Average Yield per Acre.				Total Produce in 1889.	Acreage in 1889.	Average Yield per Acre.			
			1889.	Ordinary Average.*	1889 compared with Ordinary Average.				1889.	Ordinary Average.*	1889 compared with Ordinary Average.	
					Above.	Below.					Above.	Below.
	Tons.	Acres.	Tons.	Tons.	Tons.	Tons.	Tons.	Acres.	Tons.	Tons.	Tons.	Tons.
Aberdeen	1,408,926	91,048	15.47	15.13	0.34	..	51	5	10.20	14.00	..	3.80
Argyle	88,404	5,414	16.33	15.23	1.10	..	658	49	13.43	15.49	..	2.06
Ayr	143,407	7,607	18.85	16.61	2.24	..	8,214	453	18.13	16.32	1.81	..
Banff	383,192	25,038	15.30	14 58	0.72	..	56	3	18.67	—	—	—
Berwick	500,493	28,563	17.52	17.06	0.46	..	1,082	72	15.03	21.02	..	5.99
Bute	25,049	1,401	17.88	10.55	7.33	..	· 31	2	15.50	6.50	9.00	..
Caithness	249,736	14,415	17.32	15.83	1.49	..	..	..	..	..	..	..
Clackmannan	7,901	751	10.52	14.54	..	4.02	59	4	14.75	10.50	4.25	..
Dumbarton	22,915	1,464	15.65	10.96	4.69	..	250	18	13.89	7.11	6.78	..
Dumfries	380,596	19,898	19.13	17.13	2.00	..	1,411	58	24.33	24.93	..	0.60
Edinburgh	220,685	11,699	18.86	14.92	3.94	..	166	14	11.86	16.00	..	4.14
Elgin or Moray	273,280	16,310	16.76	15.94	0.82	..	121	6	20.17	19 89	0.28	..
Fife	347,661	25,919	13.41	13.44	..	0.03	204	18	11.33	10.00	1.33	..
Forfar	612,971	33,337	18.39	17.41	0.98	..	166	9	18.44	17.13	1.31	..
Haddington	311,203	15,866	19.61	17.49	2.12	..	1,212	92	13.17	15.31	..	2.14
Inverness	158,565	11,253	14.09	14.82	..	0.73	43	2	21.50	23.50	..	2.00
Kincardine	263,574	17,842	14.77	14.37	0.40	..	..	..	..	..	..	..
Kinross	29,061	2,325	12.50	13.54	..	1.04	..	..	..	..	..	..
Kirkcudbright	250,371	13,791	18.15	17.92	0.23	..	590	40	14.75	20.76	..	6.01
Lanark	191,803	8,904	21.54	17.07	4.47	..	233	19	12.26	13.06	..	0.80
Linlithgow	63,425	3,808	16.66	15.29	1.37	..	59	5	11.80	11.00	0.80	..
Nairn	60,518	4,044	14.96	14.41	0.55	..	..	..	..	18.00	—	—
Orkney	159,909	14,265	11.21	16.81	..	5.60	..	..	..	..	..	..
Peebles	77,489	4,381	17.69	16.16	1.53	..	..	..	..	..	..	..
Perth	437,549	29,098	15.04	16.78	..	1.74	107	9	11.89	12.00	..	0.11
Renfrew	38,969	2,225	17.51	17.67	..	0.16	451	26	17.35	15.07	2.28	..
Ross and Cromarty	222,734	16,142	13.80	14.91	..	1.11	242	10	24.20	24.18	0.02	..
Roxburgh	428,403	24,399	17.56	16.23	1.33	.	159	9	17.67	23.91	..	6.24
Selkirk	36,907	2,350	15.71	15.93	..	0.22	..	..	..	..	..	..
Shetland	20,600	1,252	16.45	13.75	2.70	..	.	..	..	..	..	..
Stirling	58,696	4,242	13.84	14.55	..	0.71	71	6	11.83	11.33	0.50	..
Sutherland	45,214	2,982	15.16	17.30	..	2.14	276	12	23.00	. —	—	—
Wigtown	268,811	15,922	16.88	19.91	..	3.03	3,037	160	18.98	22.73	..	3.75
Total	7,789,017	477,955	16.30	..	..	..	18,949	1,101	17.21	..	..	..

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* As computed from Returns furnished by Estimators in 1885.

TABLE No. 5.—ESTIMATED TOTAL PRODUCTION OF HAY from Clover, Sainfoin, and Grasses under Rotation, also Total from Permanent Pasture, in the Year 1889, ACREAGE under that crop, Estimated Average YIELD per Acre, and Estimated YIELD per Acre ABOVE or BELOW an Ordinary Average Crop, in each of the COUNTIES of SCOTLAND.

COUNTIES.	FROM CLOVER, SAINFOIN, AND GRASSES.						FROM PERMANENT PASTURE.					
	Total Produce in 1889.	Acreage in 1889.	Average Yield per Acre.				Total Produce in 1889.	Acreage in 1889.†	Average Yield per Acre.			
			1889.	Ordinary Average.*	1889 compared with Ordinary Average.				1889.	Ordinary Average.*	1889 compared with Ordinary Average.	
					Above.	Below.					Above.	Below.
	Tons.	Acres.	Tons.	Tons.	Tons.	Tons.	Tons.	Acres.	Tons	Tons.	Tons.	Tons.
Aberdeen	70,988	52,722	1.35	1.46	..	0.11	3,134	3,283	0.95	1.13	..	0.18
Argyle	17,038	11,974	1.42	1.54	..	0.12	17,808	11,991	1.49	1.32	0.17	..
Ayr	63,263	35,759	1.77	1.53	0.24	..	32,841	17,015	1.93	1.75	0.18	..
Banff	19,772	15,061	1.31	1.42	..	0.11	1,514	1,507	1.00	0.99	0.01	..
Berwick	22,193	11,267	1.97	1.95	0.02	..	5,103	3,106	1.64	1.75	..	0.11
Bute	5,157	2,603	1.98	1.67	0.31	..	741	494	1.50	1.72	..	0.22
Caithness	12,700	11,249	1.13	1.63	..	0.50	3,530	3,244	1.09	—	—	—
Clackmannan	3,910	1,993	1.96	1.55	0.41	..	1,072	733	1.46	1.19	0.27	..
Dumbarton	12,836	7,131	1.80	1.70	0.10	..	3,841	2,636	1.46	1.34	0.12	..
Dumfries	26,327	17,736	1.48	1.75	..	0.27	30,003	17,462	1.72	2.05	..	0.33
Edinburgh	32,018	13,459	2.38	1.88	0.50	..	5,359	2,977	1.80	1.71	0.09	..
Elgin or Moray	9,152	8,692	1.05	1.44	..	0.39	313	441	0.71	1.00	..	0.29
Fife	56,461	28,400	1.99	1.57	0.42	..	10,737	6,753	1.59	1.41	0.18	..
Forfar	40,504	23,132	1.75	1.64	0.11	..	4,099	3,280	1.25	1.07	0.18	..
Haddington	22,185	9,791	2.27	1.89	0.38	..	2,185	1,181	1.85	1.63	0.22	..
Inverness	12,407	13,462	0.92	1.09	..	0.17	3,010	4,305	0.70	0.66	0.04	..
Kincardine	20,892	14,742	1.42	1.37	0.05	..	1,581	1,583	1.00	0.80	0.20	..
Kinross	4,426	2,544	1.74	1.59	0.15	..	1,723	849	2.03	1.49	0.54	..
Kirkcudbright	15,106	9,923	1.52	1.42	0.10	..	16,760	11,346	1.48	1.43	0.05	..
Lanark	66,074	33,405	1.98	1.56	0.42	..	24,630	11,280	2.18	1.90	0.28	..
Linlithgow	15,046	7,252	2.07	1.75	0.32	..	2,072	1,136	1.82	1.69	0.13	..
Nairn	3,775	3,586	1.05	1.40	..	0.35	374	445	0.84	1.00	..	0.16
Orkney	5,618	9,167	0.61	1.69	..	1.08	925	1,760	0.53	1.42	..	0.89
Peebles	3,845	2,470	1.56	1.44	0.12	..	3,299	2,249	1.47	1.71	..	0.24
Perth	63,882	36,014	1.77	1.69	0.08	..	17,231	13,342	1.29	1.06	0.23	..
Renfrew	30,067	14,711	2.04	1.68	0.36	..	10,127	5,632	1.80	2.29	..	0.49
Ross and Cromarty	15,380	14,950	1.03	1.40	..	0.37	1,690	2,856	0.59	0.72	..	0.13
Roxburgh	16,773	10,530	1.59	1.89	..	0.30	9,444	6,352	1.49	1.82	..	0.33
Selkirk	1,778	1,192	1.49	1 89	..	0.40	1,958	1,381	1.42	1.52	..	0.10
Shetland	781	580	1.35	2.00	..	0.65	722	1,446	0.50	1 00	..	0.50
Stirling	22,051	13,633	1.62	1.48	0.14	..	7,076	5,341	1.32	0.98	0.34	..
Sutherland	3,118	3,706	0.84	1.00	..	0.16	952	1,664	0.57	0.46	0.11	..
Wigtown	10,231	5,162	1.98	1.91	0.07	..	6,267	3,893	1.61	1.64	..	0.03
Total	725,754	447,998	1.62	..	..	..	232,121	152,963	1.52	..	..	..

* As computed from Returns furnished by Estimators in 1886.

† Exclusive of heath and mountain land.

TABLE No. 6.—NUMBER OF HORSES, CATTLE, SHEEP, AND PIGS IN EACH COUNTY OF SCOTLAND.

COUNTIES.	HORSES (including Ponies).			CATTLE.				SHEEP.			PIGS.
	Used solely for Agriculture, &c.	Unbroken Horses and Mares kept solely for breeding.	Total.	Cows and Heifers in Milk or in Calf.	Other Cattle.		Total.	1 Year Old and above.	Under 1 Year.	Total.	
					2 years and above.	Under 2 years.					
1. Aberdeen . .	20,942	5,584	26,526	41,308	44,957	74,05	160,324	113,507	54,617	168,124	10,432
2. Argyle	4,314	2,315	6,629	22,747	14,470	22,711	59,928	704,818	303,461	1,008,279	4,981
3. Ayr	6,532	2,293	8,825	48,314	14,179	33,242	95,735	210,201	134,921	345,122	15,084
4. Banff	6,638	1,787	8,425	13,589	7,822	23,069	44,480	36,915	25,488	62,403	3,790
5. Berwick	4,211	1,172	5,383	3,311	4,331	7,615	15,257	149,234	131,125	280,359	4,969
6. Bute	903	332	1,235	3,594	1,630	3,797	9,021	32,001	16,834	48,835	880
7. Caithness . . .	4,351	1,017	5,368	7,314	2,848	10,478	20,640	72,026	44,303	116,329	1,910
8. Clackmannan . . .	512	162	674	1,416	741	1,287	3,444	6,215	3,814	10,029	2,021
9. Dumbarton . . .	1,268	518	1,786	7,481	2,443	3,845	13,769	48,137	24,794	72,931	1,051
10. Dumfries . . .	5,389	1,980	7,369	17,440	11,884	24,549	53,873	309,452	187,775	497,227	13,584
11. Edinburgh . . .	3,494	974	4,468	12,200	3,563	4,166	19,929	99,990	68,933	168,923	6,177
12. Elgin	3,775	987	4,762	6,340	4,337	11,718	22,395	31,131	20,278	51,409	3,030
13. Fife	7,511	2,175	9,686	9,772	15,668	17,259	42,699	55,096	36,849	91,945	6,223
14. Forfar	8,216	1,484	9,700	11,861	17,891	17,845	47,537	88,804	50,968	139,772	6,934
15. Haddington . . .	3,123	474	3,597	1,682	3,648	3,097	8,427	73,095	51,367	124,462	2,090
16. Inverness . . .	6,561	2,004	8,565	20,481	8,398	20,179	49,058	451,271	200,358	651,629	3,680
17. Kincardine . . .	3,966	808	4,774	6,891	5,641	11,324	23,856	23,615	12,262	35,877	2,756
18. Kinross	643	235	878	1,036	1,362	3,044	5,442	18,661	13,364	32,025	493
19. Kirkcudbright . .	3,662	1,870	5,532	14,157	12,628	16,931	43,716	244,583	127,898	372,481	7,359
20. Lanark	5,673	2,137	7,810	36,769	10,329	21,686	68,784	134,205	82,572	216,777	7,953
21. Linlithgow . . .	1,494	616	2,110	4,300	2,988	3,903	11,191	18,292	6,895	25,187	1,831
22. Nairn	947	275	1,222	1,830	891	3,394	6,115	13,563	4,568	18,131	800
23. Orkney	4,888	1,227	6,115	9,301	2,975	12,531	24,807	16,791	15,048	31,839	4,449
24. Shetland . . .	902	4,037	4,939	8,298	6,122	5,843	20,263	53,876	35,571	89,447	3,152
25. Peebles	862	211	1,073	1,923	1,293	3,037	6,253	106,063	73,880	179,943	945
26. Perth	10,069	2,842	12,911	18,535	19,937	33,496	71,968	469,328	224,739	694,067	9,108
27. Renfrew	2,331	1,067	3,398	16,313	3,159	6,646	26,118	21,340	14,019	35,359	1,406
28. Ross and Cromarty .	5,807	1,465	7,272	17,768	9,004	15,737	42,509	195,411	99,159	294,570	5,777
29. Roxburgh . . .	3,748	643	4,391	4,788	4,942	6,776	16,506	270,955	217,796	488,751	4,108
30. Selkirk	471	106	577	1,029	554	1,091	2,674	91,730	69,891	161,621	511
31. Stirling	3,165	1,508	4,673	10,497	8,051	9,813	28,361	75,298	42,184	117,482	2,157
32. Sutherland . . .	2,078	615	2,693	5,353	2,236	3,679	11,268	146,152	56,779	202,931	1,028
33. Wigtown . . .	4,067	1,772	5,839	21,843	6,795	15,812	44,450	72,615	44,568	117,183	11,008
Total	142,513	46,692	189,205	409,421	257,717	453,659	1,120,797	4,454,371	2,497,078	6,951,449	151,677

TABLE NO. 7.—QUANTITIES AND VALUES OF THE IMPORTS OF LIVE CATTLE, SHEEP, AND SWINE, 1887 AND 1888.

	QUANTITIES.		VALUES.	
	1887.	1888.	1887.	1888.
	No.	No.	£	£
Live cattle	295,961	377,088	4,438,785	5,912,361
Live sheep	971,404	956,210	1,645,839	1,740,549
Live pigs	21,965	24,509	64,424	74,784
Total	1,289,330	1,357,807	6,149,048	7,727,694

TABLE NO. 8.—QUANTITIES AND VALUES OF THE IMPORTS OF BEEF, MUTTON, PORK, BACON, HAMS, FISH, EGGS, BUTTER, &c., 1887 AND 1888.

	QUANTITIES.		VALUES.	
	1887.	1888.	1887.	1888.
Meat	Cwts.	Cwts.	£	£
Beef, fresh	656,194	836,659	1,478,193	1,919,306
Beef, salted	218,054	226,943	333,044	349,634
Mutton, fresh	783,114	988,010	1,572,729	1,939,475
Unenumerated, salted or fresh	43,680	56,998	108,387	121,074
,, preserved other than by salting	520,239	542,318	1,351,769	1,376,879
Pork, salted and fresh	424,983	489,353	766,397	920,125
Bacon and hams	3,927,602	3,594,212	8,733,776	8,343,387
Total	6,573,866	6,734,493	14,344,295	14,969,880
Fish	1,604,667	1,907,644	2,032,423	2,324,365
Rabbits	117,168	99,890	312,141	276,612
Poultry and game (see value)	..	..	410,094	403,537
Butter	1,513,134	1,671,433	8,010,374	8,913,045
Margarine	1,276,140	1,139,743	3,880,327	3,268,313
Cheese	1,836,789	1,917,616	4,514,382	4,546,408
Lard	907,634	885,036	1,604,243	1,819,133
Eggs . . . Thousands	1,090,089	1,126,793	3,085,681	3,083,167
Total	..	..	23,849,665	24,634,580

TABLE NO. 9.—QUANTITIES AND VALUES OF THE IMPORTS OF WHEAT AND WHEAT-FLOUR, 1887 AND 1888.

	QUANTITIES.		VALUES	
	1887.	1888.	1887.	1888
	Cwts.	Cwts	£	£
Wheat	55,802,518	57,261,363	21 337,918	21,995,974
Wheat-flour	18,063,234	16,910,442	10,027,884	9,530,746
Total	73,865,752	74,171,805	31,365,802	31,526,720

TABLE NO. 10.—QUANTITIES AND VALUES OF THE IMPORTS OF BARLEY, OATS, INDIAN CORN, RYE, MEAL, &c., 1887 AND 1888.

	QUANTITIES		VALUES.	
	1887	1888	1887.	1888.
	Cwts.	Cwts.	£	£
Barley	14,239,566	21,305,350	3,761,497	6,070,093
Oats	14,462,943	18,770,686	3,488,329	4,598,006
Maize	31,167,325	25,370,164	7,548,272	6,888,815
Peas and beans	5,481,319	5,448,354	1,666,744	1,630,058
Rye	785,261	1,332,267	169,189	324,485
Buckwheat	67,780	101,543	18,935	28,504
Total	66,204,194	72,328,364	16,652,966	19,539,961
Oatmeal	159,015	57,145	81,882	29,887
Maize	5,522	14,745	4,934	8,001
Barley-meal Rye-meal Pea-meal and bean-meal Buckwheat-meal Meal unenumerated	731,424	589,048	185,209	152,027
Total	895,961	660,938	272,025	189,915

TABLE No. 11.—AVERAGE PRICES OF VARIOUS KINDS OF ANIMALS, DEAD MEAT, AND PROVISIONS, 1887 AND 1888.

Kind of Animals, Dead Meat, &c.		1887.	1888.
Animals—Horses	each	£16 19 8	£16 14 10
" Oxen and Bulls from all countries .	"	17 6 11	17 17 2
" Sheep, including lambs, from all countries	"	1 13 10	1 16 4
Bacon—From all countries	per cwt.	2 2 2	2 4 9
Hams—From all countries	"	2 11 11	2 12 10
Beef, salted—From all countries . . .	"	1 10 6	1 10 9
" fresh—From all countries . . .	"	2 5 0	2 5 10
Pork, salted—From all countries . . .	"	1 8 8	1 9 4
" fresh—From all countries . . .	"	2 9 4	2 5 10
Butter—From all countries	"	5 5 10	5 6 7
Margarine	"	3 0 9	2 17 4
Cheese—From all countries	"	2 9 1	2 7 5
Potatoes—From all countries	"	0 7 0	0 6 8
Eggs—From all countries	per 120	0 6 9	0 6 6
Lard—From all countries	per cwt.	1 15 4	2 1 1

TABLE No. 12.—RETURN OF THE AVERAGE PRICES OF WOOL IN THE YEARS 1887 AND 1888.

Years.	Australian.	South African.	English Fleeces.
	Per lb. s. d.	Per lb. s. d.	Per lb. s. d. s. d.
1887	0 10½	0 10½	0 9¾ to 1 0¾
1888	0 10¼	0 9¾	0 9¼ " 0 11¾

AVERAGE PRICES (PER IMPERIAL QUARTER) OF HOME-GROWN WHEAT, BARLEY, AND OATS IN THE WEEKLY MARKET OF EDINBURGH, FOR THE YEARS 1888 AND 1889.

Weekly Market day, Wednesday.		Wheat. 1888.	Wheat. 1889.	Barley. 1888.	Barley. 1889.	Oats. 1888.	Oats. 1889.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
January	1	29 9	30 11	26 6	27 6	17 0	20 10
	2	31 6	30 4	27 2	27 5	16 5	20 11
	3	30 1	28 8	26 2	27 7	17 6	20 11
	4	28 10	..	25 0	26 9	14 11	21 0
	5	..	26 0	..	27 4	..	20 9
February	1	29 2	32 0	27 10	26 0	16 6	20 10
	2	28 7	28 3	26 9	24 5	16 8	21 1
	3	28 6	31 0	25 3	22 10	17 3	20 6
	4	28 0	31 6	26 3	25 3	17 0	21 7
	5	30 1	..	26 1	..	18 0	..
March	1	31 1	28 6	26 11	24 6	17 6	21 10
	2	29 11	28 10	30 4	23 9	17 8	21 10
	3	30 0	31 0	27 5	24 3	18 1	22 6
	4	27 10	30 0	28 7	..	17 8	22 7
	5	..	..	..	..	..	..
April	1	28 10	29 5	28 10	25 2	18 8	22 10
	2	27 6	..	31 4	22 1	18 6	22 6
	3	31 7	28 6	32 1	23 7	19 7	22 2
	4	30 2	30 0	30 0	22 3	19 4	23 0
May	1	..	30 0	28 7	22 0	19 7	23 11
	2	30 9	29 0	30 5	21 8	19 8	23 1
	3	30 9	27 6	27 5	21 4	19 9	22 10
	4	30 0	26 7	26 4	21 3	20 6	23 3
	5	30 0	26 6	29 6	18 6	19 2	23 7
June	1	..	26 1	..	20 6	19 5	23 3
	2	..	25 0	..	..	19 0	23 9
	3	28 10	26 6	..	..	20 4	23 0
	4	28 0	22 3	..	20 3	21 1	23 8
	5	..	..	..	..	..	..
July	1	29 6	..	..	..	19 8	23 5
	2	30 0	..	..	23 0	19 11	23 11
	3	31 6	30 1	..	20 4	19 11	24 6
	4	32 0	28 1	28 0	22 4	21 0	24 1
August	1	33 0	29 5	30 0	20 6	21 2	23 3
	2	33 6	22 6	..	21 0	22 4	23 2
	3	34 3	27 7	..	21 10	24 3	23 11
	4	36 6	29 5	..	22 8	25 10	24 5
	5	..	..	..	21 3	26 5	25 0
September	1	37 6	28 9	..	..	27 6	23 5
	2	41 2	26 11	..	24 6	25 9	22 8
	3	38 2	28 6	..	24 8	24 2	22 0
	4	40 1	28 9	21 0	24 8	22 11	21 0
	5	..	..	..	..	..	..
October	1	42 3	29 1	24 11	22 10	22 0	20 9
	2	44 2	28 4	29 7	26 8	21 5	19 6
	3	30 0	28 1	27 9	25 1	21 7	19 3
	4	37 5	28 6	25 0	26 2	21 7	19 9
	5	35 5	28 9	23 1	25 0	20 3	20 8
Nov.	1	39 8	30 2	24 2	27 8	19 9	20 0
	2	37 7	32 0	22 8	27 11	20 5	20 4
	3	35 8	29 7	24 11	27 7	20 11	20 6
	4	31 8	30 10	25 9	25 5	21 7	20 10
December	1	30 2	30 0	25 5	25 6	21 7	20 7
	2	32 8	30 7	28 3	27 5	20 7	21 5
	3	31 2	29 8	25 7	27 10	21 3	21 9
	4	31 9	29 8	24 1	30 3	20 9	21 7
	5	..	..	..	29 2	..	21 5

PRICES OF SHEEP SINCE 1818. TABLE NO. 1.—CHEVIOT SHEEP.

Year.	Wethers.					Ewes.					Lambs.				
	s.	*d.*		*s.*	*d*	*s.*	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*
1818	28	0	to	30	0	not quoted.					8	0	to	10	0
1819	25	0	"	27	0	15	0	to	17	0	10	6	"	12	0
1820	20	0	"	25	0	16	0	"	17	0	10	0	"	11	0
1821	18	0	"	20	0	14	0	"	16	0	7	6	"	8	0
1822	12	6	"	13	0	8	0	"	8	6	4	6	"	0	0
1823	13	6	"	18	0	7	0	"	10	6	5	6	"	6	0
1824	14	0	"	19	0	7	0	"	9	0	4	6	"	6	0
1825	29	0	"	32	0	15	0	"	19	0	9	0	"	10	6
1826	17	6	"	21	6	13	0	"	15	0	7	0	"	7	6
1827	15	0	"	24	0	not quoted.					7	0	"	8	0
1828	18	0	"	27	6	12	0	to	15	0	7	0	"	8	3
1829	18	0	"	24	0	12	6	"	14	0	7	0	"	8	6
1830	15	0	"	21	0	8	0	"	11	0	6	0	"	6	9
1831	18	0	"	25	0	9	0	"	13	0	7	0	"	8	0
1832	19	0	"	24	0	11	0	"	16	0	7	0	"	9	0
1833	22	0	"	31	0	13	6	"	20	0	8	0	"	11	3
1834	22	0	"	31	0	13	6	"	21	0	9	0	"	11	6
1835	22	0	"	27	6	18	0	"	20	6	8	0	"	11	0
1836	24	0	"	31	6	16	0	"	19	0	10	0	"	14	0
1837	19	0	"	28	0	14	0	"	19	0	10	0	"	13	0
1838	23	0	"	30	6	17	0	"	22	0	12	0	"	14	0
1839	23	0	"	31	0	14	0	"	19	0	0	0	"	13	0
1840	24	0	"	33	0	15	0	"	23	0	7	0	"	11	6
1841	23	0	"	30	0	14	0	"	22	0	8	0	"	12	0
1842	22	6	"	28	0	13	0	"	17	0	7	6	"	10	0
1843	19	0	"	25	0	8	0	"	12	0	5	0	"	8	0
1844	21	0	"	59	0	10	0	"	16	0	8	0	"	10	6
1845	23	0	"	33	0	13	0	"	20	0	8	0	"	13	0
1846	24	0	"	33	6	14	6	"	21	6	10	0	"	14	6
1847	24	0	"	35	0	13	0	"	24	0	11	6	"	15	0
1848	23	0	"	34	6	13	0	"	28	0	11	6	"	15	0
1849	21	0	"	30	2	12	0	"	21	0	0	0	"	14	0
1850	20	6	"	29	6	12	0	"	20	0	8	0	"	13	0
1851	21	6	"	31	0	13	0	"	21	0	8	9	"	14	0
1852	21	0	"	32	0	15	0	"	23	0	8	0	"	14	0
1853	26	6	"	38	0	17	0	"	28	6	9	0	"	17	0
1854	25	0	"	36	0	17	0	"	26	0	9	0	"	16	6
1855	23	6	"	36	0	16	0	"	25	0	10	0	"	17	0
1856	22	0	"	35	6	15	6	"	24	0	10	0	"	15	0
1857	24	0	"	36	0	14	6	"	26	0	10	6	"	14	6
1858	24	0	"	34	6	14	0	"	24	6	10	6	"	14	0
1859	25	0	"	34	6	16	0	"	25	0	10	3	"	14	9
1860	26	0	"	38	0	17	6	"	27	6	12	6	"	17	6
1861	25	0	"	38	6	16	0	"	28	0	9	0	"	16	0
1862	27	0	"	37	6	17	6	"	28	0	10	0	"	16	0
1863	25	0	"	38	6	19	0	"	28	6	10	6	"	16	0
1864	31	0	"	41	0	21	0	"	31	6	14	0	"	18	0
1865	32	6	"	44	0	22	6	"	33	6	14	6	"	20	0
1866	37	0	"	50	0	29	0	"	42	6	15	0	"	26	0
1867	26	0	"	58	0	18	0	"	25	6	12	0	"	16	0
1868	30	0	"	32	0	15	6	"	21	0	7	6	"	13	0
1869	28	0	"	38	0	15	0	"	22	6	7	6	"	14	0
1870	35	6	"	43	0	18	0	"	28	0	10	0	"	17	0
1871	36	6	"	49	0	22	0	"	33	6	14	0	"	20	0
1872	45	0	"	56	0	32	0	"	42	0	16	0	"	22	0
1873	42	0	"	51	0	25	0	"	42	0	15	6	"	22	0
1874	33	6	"	44	6	21	0	"	36	0	12	0	"	17	0
1875	33	0	"	48	6	21	0	"	34	0	13	6	"	23	6
1876	40	0	"	52	6	23	0	"	30	0	13	6	"	25	0
1877	41	0	"	51	0	25	0	"	37	0	15	0	"	24	0
1878	35	6	"	48	0	23	6	"	35	0	14	0	"	22	0
1879	34	0	"	44	0	21	0	"	34	0	14	0	"	20	0
1880	30	0	"	43	6	20	0	"	30	0	12	6	"	20	0
1881	32	0	"	45	6	29	0	"	34	0	14	0	"	20	0
1882	40	0	"	51	0	30	0	"	40	0	14	0	"	20	6
1883	44	0	"	55	6	34	6	"	46	6	15	6	"	23	0
1884	36	0	"	47	6	29	6	"	41	6	12	6	"	20	0
1885	30	0	"	38	0	24	0	"	31	0	12	0	"	18	0
1886	32	0	"	40	0	21	0	"	29	0	12	6	"	19	0
1887	29	0	"	36	0	18	0	"	26	0	11	0	"	16	6
1888	30	0	"	38	0	19	0	"	27	0	12	0	"	17	6
1889	36	0	"	44	0	24	0	"	32	0	14	0	"	22	0

Table No. 2.—BLACKFACED SHEEP.

Year.	Wethers.					Ewes.					Lambs.				
	s.	d.		s.	d.	s.	d.		s.	d.	s.	d.		s.	d.
1819	22	0	to	24	0	12	0	to	15	0	8	0	to	9	0
1820	20	0	"	23	3	15	6	"	17	0	7	0	"	8	6
1821	18	0	"	20	0	12	0	"	13	0	6	0	"	7	0
1822	11	6	"	13	6	5	6	"	6	0	4	6	"	0	0
1823	12	0	"	16	0	5	0	"	6	6	4	0	"	5	3
1824	9	6	"	13	6	6	0	"	7	0	4	0	"	5	0
1825	22	0	"	26	0	11	0	"	13	6	6	0	"	9	0
1826	15	0	"	17	0	8	0	"	9	0	4	6	"	6	0
1827	14	0	"	18	6	7	0	"	10	0	6	0	"	7	6
1828	15	0	"	20	0	8	0	"	11	0	5	0	"	7	6
1829	14	0	"	18	0	9	0	"	10	0	6	0	"	7	0
1830	9	6	"	13	0	4	0	"	6	0	4	6	"	6	0
1831	13	0	"	17	0	5	0	"	7	6	5	0	"	6	6
1832	14	0	"	18	0	7	0	"	11	6	6	0	"	7	3
1833	16	0	"	24	0	7	6	"	12	0	6	6	"	9	0
1834	16	0	"	22	0	10	0	"	13	0	6	0	"	8	6
1835	15	0	"	18	9	10	0	"	13	0	7	0	"	8	0
1836	15	0	"	21	0	9	0	"	12	0	8	6	"	11	0
1837	13	0	"	16	0	8	0	"	12	0	8	0	"	9	6
1838	15	0	"	20	6	10	0	"	13	0	not quoted.				
1839	15	0	"	22	0	10	0	"	12	0	7	0	to	8	3
1840	15	0	"	22	6	11	0	"	12	0	7	0	"	9	3
1841	16	0	"	20	0	9	0	"	11	0	6	0	"	8	0
1842	14	0	"	19	0	7	6	"	8	0	5	6	"	7	0
1843	not quoted.					4	9	"	6	6	not quoted.				
1844	15	0	to	21	0	6	6	"	10	0	5	0	to	8	0
1845	14	0	"	23	0	8	0	"	12	0	6	0	"	8	0
1846	13	0	"	24	0	10	0	"	13	0	8	0	"	9	0
1847	20	6	"	25	0	10	0	"	14	0	8	6	"	9	6
1848	20	0	"	24	0	11	3	"	12	0	8	6	"	10	0
1849	not quoted.					not quoted.					7	0	"	7	6
1850			..					..			7	0	"	0	0
1851	17	6	to	23	0	9	0	to	12	0	6	6	"	8	0
1852	18	6	"	22	0	9	6	"	12	0	4	6	"	7	9
1853	23	0	"	27	0	14	6	"	16	6	8	0	"	11	6
1854	20	0	"	26	0	11	0	"	16	6	8	0	"	10	6
1855	23	6	"	26	6	14	0	"	16	0	10	0	"	11	0
1856	17	0	"	24	0	10	0	"	20	0	7	6	"	10	0
1857	20	0	"	29	0	10	6	"	15	0	9	3	"	11	0
1858	20	0	"	27	6	9	9	"	18	9	8	3	"	10	6
1859	20	0	"	25	0	10	0	"	14	0	8	9	"	11	0
1860	21	0	"	27	3	11	0	"	16	0	10	0	"	13	6
1861	21	0	"	29	0	12	0	"	22	0	6	3	"	14	0
1862	16	9	"	27	0	12	0	"	18	3	6	0	"	12	0
1863	20	0	"	30	6	13	0	"	16	0	8	0	"	11	6
1864	25	0	"	30	0	15	0	"	19	0	10	0	"	13	6
1865	15	6	"	32	6	15	0	"	25	0	10	0	"	17	0
1866	31	6	"	40	0	20	0	"	36	0	13	6	"	22	6
1867	20	0	"	30	6	14	0	"	22	0	7	6	"	13	6
1868	20	0	"	26	0	10	6	"	13	6	7	0	"	13	0
1869	22	0	"	28	0	11	0	"	14	0	6	9	"	9	0
1870	27	0	"	32	6	13	0	"	22	0	8	0	"	14	6
1871	23	0	"	37	0	13	0	"	23	0	11	0	"	16	3
1872	31	6	"	45	0	18	0	"	32	0	12	6	"	18	0
1873	28	0	"	39	0	16	6	"	27	0	7	0	"	16	0
1874	25	0	"	35	0	13	0	"	20	0	7	0	"	14	0
1875	26	6	"	37	6	15	0	"	21	3	9	6	"	17	6
1876	30	0	"	40	0	19	0	"	24	0	13	0	"	20	6
1877	35	0	"	38	9	18	0	"	25	0	13	6	"	23	0
1878	30	0	"	36	0	17	0	"	23	0	12	0	"	22	0
1879	25	0	"	35	9	16	0	"	24	0	10	6	"	20	0
1880	25	0	"	38	0	16	6	"	22	6	10	0	"	17	0
1881	30	0	"	39	0	15	0	"	23	0	10	0	"	15	0
1882	33	0	"	46	0	20	0	"	28	0	12	6	"	18	6
1883	36	0	"	50	6	24	6	"	33	0	14	0	"	21	6
1884	29	0	"	43	6	19	6	"	28	0	12	0	"	19	6
1885	24	0	"	34	0	18	0	"	22	6	10	0	"	15	0
1886	25	0	"	34	0	12	0	"	22	0	10	6	"	16	0
1887	22	0	"	30	0	11	0	"	19	0	8	0	"	13	0
1888	22	0	"	32	0	13	0	"	24	0	10	0	"	15	0
1889	26	0	"	40	0	18	0	"	29	0	13	0	"	22	0

TABLE No. 3.—PRICE OF WOOL, PER STONE OF 24 LB., SINCE 1818.

Year.	Laid Cheviot.	White Cheviot.	Laid Highland.	White Highland.
	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
1818	40 0 to 42 2	..	20 0 to 22 6	..
1819	21 0 〃 22 0	..	10 0 〃 10 3	..
1820	20 0 〃 22 0	..	9 0 〃 10 0	..
1821	18 0 〃 20 0	..	9 0 〃 10 0	..
1822	12 6 〃 14 6	..	5 0 〃 6 6	..
1823	9 0 〃 10 6	..	5 0 〃 5 9	..
1824	13 6 〃 15 0	..	6 0 〃 6 3	..
1825	10 6 〃 22 0	..	10 0 〃 10 6	..
1826	11 0 〃 14 0	..	5 0 〃 5 6	..
1827	11 0 〃 14 0	..	5 6 〃 6 9	..
1828	8 0 〃 11 0	..	5 6 〃 6 0	..
1829	8 6 〃 11 0	..	4 3 〃 0 0	..
1830	9 6 〃 11 0	..	4 6 〃 5 0	..
1831	17 0 〃 20 0	..	7 6 〃 8 6	..
1832	14 0 〃 16 0	..	7 0 〃 7 6	..
1833	18 0 〃 20 7	..	10 0 〃 11 0	..
1834	21 0 〃 24 6	..	5 6 〃 7 0	..
1835	19 0 〃 20 6	..	9 6 〃 10 8	..
1836	21 0 〃 25 0	..	10 0 〃 14 0	..
1837	12 0 〃 14 0	..	7 0 〃 7 8	..
1838	19 0 〃 22 6	..	6 0 〃 10 0	..
1839	18 0 〃 20 0	..	8 0 〃 12 0	..
1840	15 0 〃 0 0	..	7 0 〃 0 0	..
1841	15 0 〃 16 9	..	6 0 〃 7 5	..
1842	12 6 〃 14 0	..	not quoted.	..
1843	9 0 〃 11 6	..	5 0 to 6 0	..
1844	15 0 〃 18 0	..	not quoted.	..
1845	14 6 〃 17 6	..	7 6 to 8 6	..
1846	12 0 〃 14 6	..	8 0 〃 8 6	..
1847	12 6 〃 14 0	..	not quoted.	..
1848	9 6 〃 11 0	..	4 9 to 0 0	..
1849	12 0 〃 16 6	..	6 0 〃 6 3	..
1850	15 0 〃 17 6	..	8 0 〃 8 6	..
1851	12 0 〃 16 0	..	8 0 〃 9 3	..
1852	13 0 〃 15 0	..	8 0 〃 9 0	..
1853	19 0 〃 22 0	..	11 0 〃 12 6	..
1854	12 0 〃 15 0	..	7 6 〃 8 6	..
1855	14 6 〃 19 0	.	8 6 〃 9 0	..
1856	19 0 〃 21 6	..	11 0 〃 0 0	..
1857	19 0 〃 24 0	..	13 0 〃 14 3	..
1858	15 0 〃 17 0	..	8 9 〃 10 0	..
1859	18 6 〃 24 0	..	10 9 〃 11 6	..
1860	22 0 〃 32 0	37 0 to 38 0	10 0 〃 11 3	..
1861	19 6 〃 27 0	from 30s. upwards.	not quoted.	..
1862	18 6 〃 26 0	30 0 to 37 0	11 6 to 16 0	..
1863	25 6 〃 31 0	38 0 〃 42 0	15 3 〃 17 6	..
1864	31 0 〃 39 0	47 0 〃 54 0	17 6 〃 20 0	..
1865	23 0 〃 30 0	44 0 〃 45 0	15 0 〃 17 0	..
1866	24 0 〃 30 6	30 0 〃 38 0	14 0 〃 16 0	..
1867	16 0 〃 21 6	not quoted.	not quoted.	..
1868	19 0 〃 26 0	28 0 to 32 0	8 6 to 9 0	..
1869	18 0 〃 26 6	not quoted.	8 6 〃 10 0	..
1870	15 0 〃 23 6	25 0 to 26 0	9 6 〃 0 0	..
1871	20 0 〃 26 6	30 0 〃 34 6	12 0 〃 15 0	..
1872	26 0 〃 37 6	40 0 〃 48 0	18 0 〃 21 0	..
1873	17 0 〃 18 0	34 0 〃 40 0	9 0 〃 12 0	..
1874	18 6 〃 26 6	30 0 〃 34 0	9 6 〃 13 0	..
1875	25 0 〃 32 0	34 6 〃 36 0	12 6 〃 16 0	..
1876	20 0 〃 24 0	30 0 〃 34 6	9 6 〃 12 0	..
1877	20 9 〃 26 0	28 0 〃 30 0	10 0 〃 12 0	..
1878	18 9 〃 25 0	27 0 〃 32 0	8 6 〃 11 6	..
1879	15 0 〃 17 0	prices very low.	7 0 〃 0 0	..
1880	20 0 〃 24 0	30 0 to 32 0	10 6 〃 11 6	14 0 to 15 0
1881	17 0 〃 21 0	27 0 〃 30 0	5 0 〃 9 6	12 0 〃 13 0
1882	14 0 〃 18 0	27 6 〃 28 0	7 6 〃 9 0	13 0 〃 14 0
1883	13 0 〃 18 0	26 0 〃 28 0	6 6 〃 8 6	11 6 〃 12 6
1884	13 0 〃 18 0	26 0 〃 28 0	6 6 〃 8 6	11 6 〃 12 6
1885	12 0 〃 17 0	22 6 〃 26 0	6 0 〃 8 0	11 6 〃 12 0
1886	13 0 〃 18 0	23 0 〃 27 6	6 6 〃 8 6	11 6 〃 12 0
1887	14 0 〃 22 0	23 0 〃 28 0	7 0 〃 9 0	11 6 〃 13 0
1888	13 0 〃 20 0	23 0 〃 28 0	7 0 〃 9 0	11 0 〃 12 6
1889	13 0 〃 18 0	24 0 〃 28 0	7 0 〃 9 0	11 0 〃 12 6

BOTANICAL INVESTIGATION OF THE PASTURES OF SCOTLAND.

By A. N. M'ALPINE, Botanist to the Society.

OBJECT.

THE primary object of these investigations—conducted under the auspices of the Highland and Agricultural Society—is to find out, as accurately as possible, the nature of the vegetation forming the old pastures of Scotland, and the quantity of each constituent present; that is, to make a qualitative and quantitative botanical analysis of the pastures. With these data at command, agriculturists may be able to settle some points at present in dispute, and have a basis which may serve as a guide in laying down improved pastures in the future; at least they are in a position to anticipate and avoid the dangers that beset grass land in different districts of our country. The observations have not been confined to old pastures, but old and new leys have been examined in order to show how the composition varies at different phases of development. Assuredly, farmers ought to be put upon their guard against the many injurious or worthless constituents which may overrun their pastures, and render the land less valuable than it otherwise might be.

For easy reference, the pastures are tabulated according to the districts in which they occur, and in order of age. Knowing the composition of the best old pastures, it may be possible for the farmer to arrange his mixtures so as to imitate the good points and eliminate the bad; at least, that is the main object of these investigations.

METHOD OF EXAMINATION.

Regulations.

It was decided in consultation with the Special Committee appointed to direct the investigation that inquiry should be carried out according to the following regulations:—

1. The pastures to be made the subject of examination should be fairly representative of the best permanent pastures in different parts of the country.

2. The occupier of the field to be investigated shall enclose, at his own expense, with close wire netting, a patch not less than 6 feet square, the top as well as the sides to be enclosed, so that the full season's growth of grass may be preserved from beasts and birds.

3. The Society's Botanist will visit the selected fields in April, advise with the occupiers as to the spot to be enclosed, make

then as far as he can a botanical examination of the field, and cut and take with him a small turf, by means of which he may make a fuller examination into the classes and characteristics of the plants composing the pasture.

4. The Botanist will again visit the fields in July or August, and will then, by the aid of the preserved patch, make a more complete botanical examination of the field—noting the condition of the various grasses after the season's grazing. He will also carefully cut the grass from, say, 18 inches square of the enclosed patch, take the grass with him, examine it botanically, and tabulate the proportions of each plant represented.

5. Information as full and as accurate as possible to be obtained on the following points in regard to the fields under examination by the Botanist on visiting the farm:—

(*a*) The altitude of the field above sea-level, its exposure, and the average rainfall of the district.

(*b*) The character of the soil and subsoil, depth of each, and the character of the underlying rocks or deposits.

(*c*) The condition of the field as to drainage. Has it been drained artificially, and if so, when?

(*d*) When was the field sown out in grass? What grasses were sown, with what crops, and what manure, if any; and what was the previous treatment of the field?

(*e*) What has been the treatment of the field since laid down? What manure, if any, has been applied on the grass, and when? By what class of stock grazed? Has it ever been cut for hay, and if so, how often, and when?

(*f*) What character does the field bear in the district for the rearing and feeding of stock, and what is it considered worth per acre of annual rent?

(*g*) Does it impart any peculiar flavour or other property to milk or butter?

Note on Regulation 2.—The objects to be attained by enclosing a fairly large patch of the pasture, where it grows, are:—(1) To obtain a knowledge of the produce per acre; (2) To get the plants in flower for confirming identification. When a turf is removed from a pasture, it must, for various reasons, be thin. Such a turf, when transplanted and brought to the flowering stage, is apt to mislead an observer regarding the composition of the pasture from which it has been taken, not only because of the removal of the deep roots, but because the soil and climate, to which the grass is now exposed, have been changed. In my own experiments, the rye-grass was much more luxuriant in the thin transplanted turfs than in the tracts enclosed in the field. Further observations on the changed vegetation of the transplanted turfs may be made during the present season.

Note on Regulation 3.—As a guide in cutting the turf a square zinc frame is used. The square is laid on a fairly representative portion of the pasture, as free from weeds as possible, and a turf 3 or 4 inches in depth removed. Two turfs were taken from each pasture: one was planted in garden soil; the other was washed, to free it from earth, and the component plants isolated by teasing. In examining the fields in April and May, no difficulty whatever was experienced in determining the botanical nature of the constituents from the foliage; indeed, it was easy to make a tolerably complete inventory of the composition of the fields at this early season. Unless a pasture is examined thus early in the year, some of the components are liable to be overlooked, and certain constituents underestimated.

Note on Regulation 4.—The visit in August was undertaken for the purpose of extending and confirming the observations made in the early part of the year. In the enclosed plots most of the grasses were in seed, and easily identified, except the very earliest. In some of the plots, on very old pastures, certain grasses—such as cocksfoot, Yorkshire fog, &c.—had apparently never flowered, and it is quite conceivable that very old plants may lose their habit of flowering altogether; but this interesting point requires careful and extended observation. A peculiarity of crested dogstail was very apparent in some of the enclosed areas. On two plots in the same field, with practically equal amounts of crested dogstail, the number of culms in the one were much more abundant than in the other: on inquiry, it was found that the culms were least abundant in the plot enclosed about a fortnight later than the other. Several observations of this kind were made. The practical conclusion seems to be that the unsightly appearance of pastures in autumn, and the accruing loss to the owner, so far as caused by the culms of crested dogstail, may, to a large extent, be removed by extended depasturing in spring.

DEPTH OF ROOTS.

The depth to which the roots of pasture plants descend, although of considerable practical importance, has as yet received extremely little attention. It was, therefore, advisable to make special observations on the point. By digging into the soil to a sufficient depth, and smoothing a vertical surface, it is perfectly easy to roughly measure the root-depth by means of a footrule; this has been done in the case of all the pastures examined. To obtain an idea of the root-depth of various pasture plants, the experimental plots of Messrs Roughead and Park, Haddington, were examined. The soil is a rich garden loam, and the conditions were favourable to very accurate measurement.

	Name of Plant.	Root-depth. Inches.
1.	Tall fescue	26
2.	Cocksfoot	24
3.	Meadow fescue	20
4.	Timothy	16
	Smooth-stalked meadow-grass	
5.	Perennial rye-grass	15
	Italian rye-grass	
	Red clover	
	White clover	
6.	Sheep's fescue	14
	Wood meadow-grass	
	Meadow-foxtail	
7.	Alsike	13

The bulk of the roots had the following depths:—

	Name of Plant.	Inches.
1.	Tall fescue	10
	Cocksfoot	
	Meadow fescue	
2.	Red clover	9
3.	Perennial rye-grass	8
	Smooth-stalked meadow-grass	
4.	Meadow-foxtail	7
5.	Timothy	6
	Wood meadow-grass	
	Rough-stalked meadow-grass	
6.	Sheep's fescue	5
	Italian rye-grass	

With regard to sheep's fescue it is worth noting that, although shallow-rooted, the foliage is scant and bristle-like; hence it is that the plants can withstand drought so well.

STATEMENT OF RESULTS.

Districts Examined.

Pastures in the following districts have been examined:—

I. Perth (Athole).
II. Fife (Stravithy).
III. Edinburgh (Barnton).
IV. Ayrshire (Dalry).
V. Lanark (including Newton and Cleghorn).
VI. Stirling (Sauchie).
VII. Lauderdale (Boon).
VIII. Kirkcudbright (Howell).

Qualitative Analysis.

The data under this head were obtained from a general examination of the field in April and in August.

Quantitative Analysis.

The quantities were obtained—1. By teasing out the constituents of a turf taken about the end of April. The isolated components were set in a surface of wet sand, and the area occupied by each constituent estimated by measurement. 2. By examination of the produce of the enclosed plot. 3. By examination of the produce of a turf planted in garden soil. To be of practical utility, the quantities found must be stated in figures capable of being readily expressed in lbs. of pure and germinating seed, and this for the reason that the farmer may desire to know what mixture of seed should be sown in order to imitate as closely as possible some good old pasture already in existence in his district. That this plan would be advisable, I do not at all assert, but, at any rate, it is desirable that the agriculturist should compare the mixture he actually sows with that which would be necessary to imitate an old pasture. In the latter, he sees under his very eyes the final issue of the struggle between the various combatants, and surely this final result ought to be borne in mind, if the ultimate issue is to be modified to his own advantage. To meet these requirements, the quantities represent *area occupied* and not weight.

Weight of Produce per Acre.

In the month of August a square foot of the produce was taken from the enclosed plot, dried, and weighed. From this weight the produce per acre is found by a simple calculation.

DISTRICT I.—PERTHSHIRE (ATHOLE).

	No.	Name of Pasture.	Age.	Altitude (about).	Soil.	Root-depth	Remarks.
				Ft.		In.	
Recent.	1	Kinnaird 2 .	Laid down, 1887	80	Very light loam. Change begins at 10 in.	10	Farmyard manure applied.
	2	Lower Bringham.	Laid down, 1886	140	Light loam. Depth, 8 in.	8	Course of cropping—(1) oats; (2) hay, (3) grazed by sheep. Only brought into cultivation twenty years ago.
	3	Upper Bringham.	"	180	Light loam. Depth, 18 in.	18	Has been in cultivation for ages.
	4	Balmacneill .	Laid down, 1884	80	A light loam, slightly heavier than 3.	13	Grazed by sheep and cattle.
Old.	5	Kincraigie Hill	Old.	300	Light loam; subsoil till. Depth, 16 in.	16	Grazed by sheep and cattle.
	6	Kinnaird 1 .	Not ploughed within the memory of man.	80	Very loose; loose and sandy. Dep., 11 inches.	11	Covered by water at certain seasons. A hay crop occasionally taken.

QUALITATIVE ANALYSIS.

Note.—p, *present;* —, *absent.*

	Recent Pastures.			Old Pastures.	
	No. 1.	Nos. 2 & 3.	No. 4.	No. 5.	No. 6.
HERBAGE.					
Gramineæ—					
Perennial rye-grass	p	p	p	—	—
Cocksfoot	p	p	p	—	—
Timothy	p	p	p	—	—
Yorkshire fog	p	p	p	—	—
Creeping soft-grass	p	p	—	—	—
Sheep's fescue	p	p	p	p	—
Crested dogstail	p	p	p	p	p
Sweet vernal	p	p	traces	p	p
Common bent	p	p	p	p	p
Couch-grass	p	p	p	—	—
Decumbent heath-grass	—	—	—	p	—
Annual brome	—	p	—	—	—
Leguminosæ—					
White clover	p	p	p	p	p
Red clover	p	p	—	—	—
Alsike	p	p	traces	—	—
Plantagineæ—					
Rib-grass	p	p	p	—	—
Compositæ—					
Yarrow	p	p	traces	p	—
WEEDS.					
Buttercups	p	p	p	—	—
Chickweed	p	p	—	p	—
Tormentil	—	—	—	p	—
Galium	—	—	—	p	—
Ox-eye daisy	p	—	—	—	—
Daisy	p	p	p	—	—
Thistles	p	p	p	—	—
Heath	—	—	p	—	—
Speedwell	—	—	—	p	—
Self-heal	p	p	—	—	—
Sorrel	p	p	p	—	—
Field-woodrush	—	—	p	—	—

QUANTITATIVE ANALYSIS.

Pasture No. 1.

Percentage composition of gramineous herbage:—

	Area occupied.
Perennial rye-grass	50
Timothy	20
Cocksfoot	19
Sheep's fescue	3

	Area occupied.
Yorkshire fog	2
Sweet vernal	2
Bent-grass	2
Crested dogstail	2
Total	100

Perennial rye-grass, timothy, and cocksfoot form the bulk of the gramineous herbage.

The clover varies in amount on different parts of the field.

Daisies, narrow-leaved rib-grass, and thistles are prevalent.

Pastures No. 2 and 3.

	Area occupied.
Herbage	97
Weeds	3
Total	100

Percentage composition of gramineous herbage:—

	Area occupied.
Crested dogstail	37
Timothy	17
Cocksfoot	16
Agrostis	10
Perennial rye-grass	8
Yorkshire fog	5
Sweet vernal	4
Sheep's fescue	3
Total	100

The proportion of clover varies on different parts of the field.

The perennial rye-grass, originally sown, has largely died out; its place is taken by crested dogstail and agrostis—the main indigenous grasses of this district.

Daisies are very prominent weeds.

Pasture No. 4.

	Area occupied.
Herbage	97
Weeds	3
Total	100

Percentage composition of gramineous herbage:—

	Area occupied.
Bent	33
Crested dogstail	27
Timothy	14
Cocksfoot	10
Perennial rye-grass	3
Yorkshire fog	7
Sheep's fescue	6
Total	100

Bent-grass and crested dogstail have now taken the upper hand, and perennial rye-grass has almost died out.

The clovers vary in amount on different parts of the field.

Pasture No. 5.

	Area occupied.
Herbage	97
Weeds	3
Total	100

Percentage composition of gramineous herbage:—

	Area occupied.
Sheep's fescue	55
Sweet vernal	30
Bent	15
Total	100

The proportion of white clover varies on different parts.

Pasture No. 6.

Bent-grass, crested dogstail, sweet vernal, and white clover form the bulk of the herbage. Perennial rye-grass does not occur.

WEIGHT OF PRODUCE PER ACRE.

Pasture.	Tons.	Cwt.
No. 1	2	18
" 2	0	16
" 3	3	18
" 4	3	0
" 5	1	16

Note.—Pasture No. 2 has the shallowest soil, and the produce is at a minimum.

DISTRICT II.—FIFE (STRAVITHY).

No.	Name.	Age.	Altitude.	Soil.	Root-depth.	Remarks.
			Ft.		In.	
1	Pasture in front of house.	Old.	275	Light loam, 20 inches deep, slightly stony, well drained on the whole.	11	Drained artificially about eight years ago. Generally speaking, the drainage is good. Depastured chiefly by sheep.
2	Pasture east of Stravithy Mill.	Old.	..	As above—20 inches deep.	18	Limed about ten years ago. Ground rock-salt and ground bones have been once applied. This field was drained about twenty five-years ago; drainage is now fairly good.

QUALITATIVE ANALYSIS.

HERBAGE.	Pasture No. 1.	Pasture No. 2.
Gramineæ—		
Perennial rye-grass	p	p
Crested dogstail	p	p
Timothy	p	—
Cocksfoot	p	p
Sweet vernal	p	p
Smooth-stalked meadow	p	p
Sheep's fescue	p	p
Bent	p	p
Fiorin	p	—
Yorkshire fog	p	p
Tufted hair-grass	p	—
Leguminosæ—		
White clover	p	p
Bird's-foot trefoil	p	p
Vetchling	—	p
Compositæ—		
Yarrow	p	—
Plantagineæ—		
Rib-grass	p	p
WEEDS.		
Buttercups	p	p
Self-heal	p	p
Nipple-wort	p	p
Cat's-ear	p	—
Dandelion	p	—
Daisy	p	p
Thistle	p	p
Sorrel	p	p
Lady's-mantle	—	p
Yellow-rattle	—	p
Speedwell	—	p
Moss	—	p

QUANTITATIVE ANALYSIS.

Pasture No. 1.

	Area occupied.
Herbage	90
Weeds	10
Total	100

		Area occupied.
Herbage	Gramineous	90
	Leguminous	10
	Total	100

The leguminous herbage is mainly white clover.

Percentage composition of gramineous herbage:—

	Area occupied.
Perennial rye-grass	5
Crested dogstail	9
Timothy	5
Cocksfoot	5
Sweet vernal	3
Smooth-stalked meadow	5
Sheep's fescue	20
Bent	30
Fiorin	3
Yorkshire fog	15
Tufted hair-grass	Traces
Total	100

Bent, sheep's fescue, and Yorkshire fog are the most abundant grasses.

Pasture No. 2.

		Area occupied.
Herbage		94
Weeds		6
Total		100
Herbage	Gramineous	70
	Leguminous	30
Total		100

Percentage composition of gramineous herbage:—

	Area occupied.
Perennial rye-grass	Traces
Crested dogstail	60
Cocksfoot	3
Sweet vernal	3
Smooth-stalked meadow	4
Sheep's fescue	8
Bent	7
Yorkshire fog	15
Total	100

Crested dogstail forms the bulk of the grass.

DISTRICT III.—EDINBURGH (BARNTON PARKS).

No.	Age.	Altitude (about).	Soil.	Root-depth	Remarks.
		Ft.		In.	All the fields are depastured by cattle & sheep.
1	Laid down, 1884	160	Rich darkish loam, continuous with subsoil.	24	Course of cropping—(1) white crop; (2) pasture for cattle and sheep. No hay taken. Previous to this, white and green crops alternated for twelve years. Exposure, north-west. Value, £3, 10s per acre.
2	Laid down, 1884	220	Rich reddish light loam Depth of soil, 11 in. Subsoil, sandy gravel.	19	Course of cropping as before. Exposure, north. Value, £8 per acre.

DISTRICT III.—*continued.*

No.	Age.	Altitude.	Soil.	Root-depth.	Remarks.
		Ft.		In.	
3	Laid down, 1882	120	Brown loam. Depth of soil, 18 in. Subsoil, sandy gravel.	22	An extremely heavy wheat crop was taken; afterwards the grass was renovated. Exposure, north-east. Value, £3, 10s. per acre.
4	Twenty years at least.	140	Rich black loam. Depth of soil, 13 in. Subsoil, sandstone.	17	Exposure, east. Value, £3, 10s. per acre.
5	Thirty years at least.	150	Rich reddish-brown clay loam. Depth of soil, 15 in. Subsoil, sandy clay.	29	Exposure, south. Value, £3, 10s. per acre.
6	Thirty years at least.	150	Rich brown loam. Depth of soil, 12 in. Subsoil, sandy clay.	22	Exposure, south-west. Value, £3, 10s. per acre.

QUALITATIVE ANALYSIS.

	Pastures.					
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
HERBAGE.						
Gramineæ—						
Perennial rye-grass	p	p	p	p	p	p
Crested dogstail	p	—	p	p	p	p
Timothy	p	—	p	p	—	—
Meadow foxtail	—	—	—	—	p	—
Yorkshire fog	p	p	p	p	p	p
Tufted hair-grass	—	—	—	—	—	p
Cocksfoot	p	—	p	p	—	p
Sweet vernal	—	p	p	p	p	p
Sheep's fescue	—	p	p	p	p	p
Smooth-stalked meadow	—	p	p	p	p	p
Rough-stalked meadow	—	—	p	—	p	p
Bent	p	p	p	p	p	p
Leguminosæ—						
White clover	p	p	p	p	p	p
Plantagineæ—						
Rib-grass	—	—	—	p	—	—
WEEDS.						
Buttercups	—	—	p	p	p	p
Dandelion	p	—	—	p	—	—
Daisy	p	—	few	—	p	—
Thistle	p	—	p	p	p	—
Dock	—	—	—	p	p	—
Sorrel	—	—	—	—	p	—
Nettle	—	—	—	—	—	p (in patches)

QUANTITATIVE ANALYSIS.

Pasture No. 1.

	Area occupied.
Herbage	97
Weeds	3
Total	100

Percentage composition of gramineous herbage:—

	Area occupied.
Perennial rye-grass	3
Crested dogstail	4
Timothy	10
Yorkshire fog	12
Cocksfoot	47
Bent	24
Total	100

The amount of clover varies in different parts of the field; it grows freely.

Daisies are very prevalent.

Pasture No. 2.

	Area occupied.
Herbage	97
Weeds	3
Total	100

Percentage composition of gramineous herbage:—

	Area occupied.
Perennial rye-grass	6
Yorkshire fog	41
Sweet vernal	8
Sheep's fescue	3
Smooth-stalked meadow	6
Bent	36
Total	100

Bent-grass and Yorkshire fog form the bulk of the grass herbage. Very little clover is present.

Pasture No. 3.

	Area occupied.
Herbage	98
Weeds	2
Total	100

Percentage composition of gramineous herbage:—

	Area occupied.
Perennial rye-grass	5
Crested dogstail	13
Timothy	5
Yorkshire fog	23
Cocksfoot	15
Sweet vernal	5
Sheep's fescue	0
Smooth-stalked meadow	4
Rough-stalked meadow	5
Bent	25
Total	100

The bulk of the grass is bent, Yorkshire fog, and crested dogstail.

The clover varies on different parts.

Pasture No. 4.

	Area occupied.
Herbage	97
Weeds	3
Total	100

Percentage composition of gramineous herbage:—

	Area occupied.
Perennial rye-grass	2
Crested dogstail	27
Timothy	1
Yorkshire fog	26
Cocksfoot	2
Sweet vernal	4
Sheep's fescue	3
Smooth-stalked meadow	5
Bent	30
Total	100

Bent, Yorkshire fog, and crested dogstail form the bulk of the grass.

Pasture No. 5.

	Area occupied.
Herbage	98
Weeds	2
Total	100

Percentage composition of gramineous herbage:—

	Area occupied.
Perennial rye-grass	Traces
Crested dogstail	26
Meadow foxtail	3

	Area occupied.
Yorkshire fog	25
Sweet vernal	5
Sheep's fescue	5
Smooth-stalked meadow	5
Rough-stalked meadow	4
Bent	27
Total	100

Bent, crested dogstail, and Yorkshire fog form the bulk of the grass.

Pasture No. 6.

	Area occupied.
Herbage	98
Weeds	2
Total	100

Percentage composition of the gramineous herbage:—

	Area occupied.
Perennial rye-grass	2
Crested dogstail	15
Yorkshire fog	12
Tufted hair-grass	Traces
Cocksfoot	4
Sweet vernal	5
Sheep's fescue	4
Smooth-stalked meadow	4
Rough-stalked meadow	4
Bent	50
Total	100

Bent, dogstail, and Yorkshire fog again form the bulk of grass herbage.

Weight of Dry Produce per Acre.

	Pasture.	Tons.	Cwt.
Recent	No. 1	3	18
	" 2	6	16
	" 3	4	16
Old	" 4	5	2
	" 5	5	0
	" 6	5	18

In this district smooth-stalked meadow-grass is not eaten by stock, as is well exemplified by the Double-dykes field.

DISTRICT IV.—AYRSHIRE (DALRY).

No.	Name.	Age.	Altitude.	Soil.	Root-depth.	Remarks.
			Ft.		In.	
1	(4)	5 years in grass.	275	Loam, slightly brown. Depth, 12 inches. Subsoil, an ochreous loamy clay.	18	Limed before the white crop.
2	(5)	7 years in grass.	320	Loam, subsoil somewhat clayey and stony. Depth of soil, 10 in.	18	Limed within the last two years. Farmyard manure, bones, and guano had been previously applied.
3	(3)	?	300	Loam, slightly brown. Depth, 15 in.	15	Manure; limed; farmyard manure applied; 4 cwt bones applied after the second year's hay was taken.
4	(2)	14 years under pasture.	320	As before.	15	Lime compost applied three years ago.
5	(1)	25 years.	350	Loam, slightly brown. Depth, 18 inches, resting on rock (Porphyrite).	18	Twice limed — the last application two years ago; tile-drained 25 years ago; drains 4 feet deep.

The mixture usually sown in this district is—

Perennial rye-grass . .	2	bushels.
Timothy	3	lb.
Cocksfoot	1 to 2	"
Crested dogstail . . .	½	"
White clover . . .	3	"
Red clover	5	"

The course of cropping is usually—

Two crops of oats. One of hay. Pasture by dairy cows.

QUALITATIVE ANALYSIS.

	Pastures.				
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
HERBAGE.					
Gramineæ—					
Perennial rye-grass	p	p	p	p	traces
Crested dogstail	p	p	p	p	p
Timothy	p	p	p	p	—
Cocksfoot	—	p	p	—	—
Sweet vernal	p	p	—	p	p
Bent	p	p	p	p	p
Yorkshire fog	p	p	p	p	p
Annual meadow-grass . .	p	—	—	—	—

QUALITATIVE ANALYSIS—*continued.*

	Pastures.				
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
HERBAGE—*continued.*					
Compositæ—					
Yarrow	—	—	—	p	p
Leguminosæ—					
Bird's-foot trefoil	—	p	—	p	—
White clover	p	p	p	p	p
Vetchling	p	—	p	p	p
Cow-grass	—	—	—	p	—
Plantagineæ—					
Rib-grass	p	p	p	p	p
WEEDS.					
Buttercups	p	p	p	p	p
Lady's-mantle	p	p	p	p	p
Silver-weed	p	p	p	p	—
Daisy	p	p	p	p	p
Thistle	p	p	p	p	p
Cat's-ear	p	—	—	p	p
Self-heal	p	p	p	p	p
Sorrel	—	p	p	p	p
Chickweed	p	p	p	p	p
Dock	—	—	p	p	—
Bartsia	—	—	p	—	—
Field horse-tail	—	—	p	—	—
Hard-head	—	—	—	p	—
Ragweed	—	—	—	p	p

QUANTITATIVE ANALYSIS.

Pasture No. 1.

	Area occupied.
Herbage	96
Weeds	4
Total	100

Clover is very luxuriant, and in some parts of the field has taken complete possession.

Percentage composition of gramineous herbage:—

	Area occupied.
Perennial rye-grass	75
Crested dogstail	5
Timothy	8
Sweet vernal	3
Bent	3
Yorkshire fog	6
Total	100

Pasture No. 2.

	Area occupied.
Herbage	97
Weeds	3
Total	100

Clover very luxuriant as before.

Percentage composition of gramineous herbage:—

	Area occupied.
Perennial rye-grass	60
Crested dogstail	15
Timothy	8
Cocksfoot	4
Sweet vernal	3
Bent	5
Yorkshire fog	5
Total	100

Pasture No. 3.

	Area occupied.
Herbage	95
Weeds	5
Total	100

Clover as before.

Percentage composition of gramineous herbage:—

	Area occupied.
Perennial rye-grass	65
Crested dogstail	12
Timothy	10
Cocksfoot	7
Bent	2
Yorkshire fog	4
Total	100

Pasture No. 4.

	Area occupied.
Herbage	90
Weeds	10
Total	100

		Area occupied.
Herbage	Gramineous	89
	Leguminous	11
Total		100

Percentage composition of gramineous herbage:—

	Area occupied.
Perennial rye-grass	2
Crested dogstail	76
Timothy	3

	Area occupied.
Sweet vernal	2
Bent	10
Yorkshire fog	7
Total	100

Crested dogstail forms a very great part of the grass.

Lady's-mantle, daisies, and dandelions abound.

The rye-grass in this field may be perennial, but it certainly has died out to a very large extent.

Pasture No. 5.

	Area occupied.
Herbage	97
Weeds	3
Total	100

Clover and leguminous plants are very luxuriant, on some parts occupying the whole ground.

Percentage composition of gramineous herbage:—

	Area occupied.
Perennial rye-grass	2
Crested dogstail	80
Sweet vernal	4
Bent	10
Yorkshire fog	4
Total	100

This field was sown down with rye-grass, which has now practically disappeared.

The herbage is said to give a hawthorn flavour to milk and cheese in the month of June.

WEIGHT OF PRODUCE PER ACRE.

	Green.		Dry.		A dairy cow requires.
Pasture.	Tons.	Cwt.	Tons.	Cwt.	Acres.
No. 1	7	6	3	1	1½
" 2	5	8	2	8	2½
" 3	5	4	2	8	2
" 4	10	0	3	0	2
" 5	11	4	3	12	2¼

DISTRICT V.—LANARK (NEWTON, GLASGOW).

No.	Name.	Age.	Altitude.	Soil.	Root-depth.	Remarks.
			Ft.		In.	
1	(25)	Laid down, 1886	158	Red sandy loam. Depth, 19 inches.	19	Course of cropping—(1) white crop; (2) two years' hay; (3) dairy pasture. Value, £2 per acre.
2	(19)	4 or 5 years.	50	Average alluvial loam, red coloured, not drained.	24	The mixture sown was—Timothy, 20 lb.; Italian rye-grass, 1 bushel. Course of cropping as before. Neither manured nor drained. Value, £2, 10s. per acre.
3	(16)	Laid down, 1883	50	Heavy alluvial clay, yellowish brown. Depth, 18 inches.	18	Course of cropping—(1) oats; (2) pasture. No hay taken. Stubble manured with rotted weeds and lime.
4	(30)	Laid down, 1879	130	Red sandy loam, somewhat firm. No drainage. Subsoil thin, beds of clay resting on sand. Depth of soil, 15 in.	15	Course of cropping—(1) wheat; (2) hay, one year; (3) pasture. Two top-dressings of manure on stubble. Value, £2 per acre.

QUALITATIVE ANALYSIS.

	Pastures.			
	No. 1.	No. 2.	No. 3.	No. 4.
HERBAGE.				
Gramineæ—				
Perennial rye-grass	p	p	p	traces
Crested dogstail	p	p	p	p
Timothy	p	p	p	—
Cocksfoot	p	p	p	traces
Sweet vernal	—	—	—	—
Smooth-stalked meadow-grass	p	p	p	—
Rough-stalked meadow-grass	—	—	p	—
Sheep's fescue	p	—	—	—
Bent-grass	p	p	p	p
Yorkshire fog	p	p	p	p
Meadow foxtail	—	—	p	—
Annual meadow-grass	p	—	—	—
Meadow fescue	—	—	p	—
Leguminosæ—				
White clover	p	—	p	p
Plantagineæ—				
Narrow-leaved rib-grass	p	p	—	p
Broad-leaved rib-grass	p	—	—	—

QUALITATIVE ANALYSIS—*continued.*

	Pastures.			
	No. 1.	No. 2.	No. 3.	No. 4.
WEEDS.				
Buttercups	p	p	p	p
Thistle	p	—	—	—
Ragweed	p	p	p	—
Daisy	p	p	p	p
Dandelion	p	—	—	—
Dock	p	—	—	—
Sorrel	—	p	—	p
Self-heal	p	p	—	—
Cerastium	p	—	—	—
Chickweed	—	—	—	p
Rush	—	—	—	p

QUANTITATIVE ANALYSIS.

Pasture No. 1.

	Area covered.
Herbage	85
Weeds	15
Total	100

The whole field is capable of bearing clover; on some parts the herbage is entirely grass, on others entirely clover.

Percentage composition of gramineous herbage:—

	Area covered.
Perennial rye-grass	69
Crested dogstail	7
Timothy	3
Cocksfoot	7
Smooth-stalked meadow	2
Sheep's (hard) fescue	10
Bent-grass	2
Total	100

Pasture No. 2.

Percentage composition of gramineous herbage:—

	Area covered.
Perennial rye-grass	2
Crested dogstail	4
Timothy	2
Smooth-stalked meadow	2

	Area covered.
Cocksfoot	5
Bent	35
Yorkshire fog	50
Total	100

The bulk of the grass is bent and Yorkshire fog.

Clover does not grow in this pasture.

The field was sown with a mixture of timothy and Italian.

Pasture No. 3.

Percentage composition of gramineous herbage:—

	Area covered.
Perennial rye-grass	12
Crested dogstail	35
Timothy	25
Cocksfoot	8
Smooth-stalked meadow Rough-stalked meadow	5
Bent	7
Yorkshire fog	5
Meadow fescue	3
Total	100

Clover grows well on this field.

No culms of crested dogstail are seen in the autumn, because of the close grazing in spring.

Pasture No. 4.

	Area covered.
Herbage	98
Weeds	2
Total	100

		Area covered.
Herbage	Gramineous	90
	Leguminous	10
	Total	100

Percentage composition of gramineous herbage:—

	Area covered.
Crested dogstail	40
Bent	30
Yorkshire fog	25
Other grasses	5
Total	100

DISTRICT V.—LANARK—*continued* (CLEGHORN).

No.	Name.	Age.	Altitude.	Soil.	Root-depth.	Remarks.
			Ft.		In.	
1	Loanfoot	Laid down 188?.	700	Light red loam. Subsoil red and clayey, somewhat porous. Not drained. Depth, 12 in.	12	Not drained. Course of cropping: (1) white crop; (2) hay, one year, cut before seeds are ripe; (3) sheep pasture.
2	Lowgate	At least 30 years.	"	Strong dark-brown loam. Subsoil light brown and porous. Good drainage. Depth of soil, 20 inches.	25 (5 in. in subsoil).	Drained Sheep pasture. Animals fed on cotton and linseed cakes, with oats.
3	Highgate	35 years.	750	Strong dark-brown loam. Subsoil light brown and porous. Good drainage. Depth, 19 in.	17	Well drained. Farmyard manure applied when the ley was made; no further application of manure. Grazed by sheep and cattle.
4	Pleasure-ground.	At least 50 years.	"	Depth, 16 in. Never drained, and drainage not required.	20 (4 in. in subsoil).	Never drained, and drainage unnecessary. Very little moss is present.

Qualitative Analysis.

	Pastures.			
	No. 1.	No. 2.	No. 3.	No. 4.
HERBAGE.				
Gramineæ—				
Perennial rye-grass	p	—	p	p
Meadow fescue	p	—	—	—
Crested dogstail	p	p	p	p
Timothy	p	—	—	—
Cocksfoot	p	—	—	—
Sweet vernal	p	p	—	p
Smooth-stalked meadow	p	—	p	p
Rough-stalked meadow	p	—	—	—
Bent	p	p	p	p
Yorkshire fog	p	p	p	p
Meadow foxtail	p	—	—	—
Sheep's fescue	p	p	—	p
Leguminosæ—				
White clover	p	p	p	p
Plantagineæ—				
Rib-grass	p	p	—	p

QUALITATIVE ANALYSIS—*continued.*

	Pastures.			
	No. 1.	No. 2.	No. 3.	No. 4.
WEEDS.				
Mouse-ear chickweed	—	p	p	p
Self-heal	—	—	p	—
Buttercups	p	p	p	p
Thistle	p	p	p	p
Daisy	p	p	p	p
Long-rooted cat's-ear	—	p	—	—
Sorrel	p	p	—	p

QUANTITATIVE ANALYSIS.

Pasture No. 1.

	Area covered.
Herbage	97
Weeds	3
Total	100

Clover is very scant.

Percentage composition of gramineous herbage:—

	Area covered.
Perennial rye-grass	6
Meadow fescue	5
Crested dogstail	48
Timothy	8
Cocksfoot	4
Sweet vernal	3
Smooth-stalked meadow	4
Rough-stalked meadow	2
Bent	6
Yorkshire fog	6
Meadow foxtail	2
Sheep's fescue	6
Total	100

Pasture No. 2.

	Area covered.
Herbage	97
Weeds	3
Total	100

		Area covered.
Herbage	Gramineous	98
	Leguminous	2
	Total	100

Percentage composition of gramineous herbage:—

	Area covered.
Crested dogstail	37
Sweet vernal	8
Yorkshire fog	10
Meadow foxtail	2
Sheep's fescue	7
Bent	36
Total	100

Crested dogstail, bent, and Yorkshire fog are the chief constituents.

Pasture No. 3.

	Area covered.
Herbage	95
Weeds and moss	5
Total	100

		Area covered.
Herbage	Gramineous	97
	Leguminous	3
	Total	100

Percentage composition of gramineous herbage:—

	Area covered.
Perennial rye-grass	3
Crested dogstail	40
Smooth-stalked meadow	15
Bent	37
Yorkshire fog	5
Total	100

Pasture No. 4.

	Area covered.
Herbage	97
Weeds	3
Total	100

Percentage composition of gramineous herbage:—

	Area covered.
Perennial rye-grass	2
Crested dogstail	40
Sweet vernal	6
Smooth-stalked meadow	3
Bent	40
Yorkshire fog	4
Sheep's fescue	5
Total	100

Crested dogstail and bent are again the principal constituents.

WEIGHT OF DRY PRODUCE PER ACRE.

Pasture.	Tons.	Cwt.
No. 1.	3	16
„ 2.	4	18
„ 3.	3	11
„ 4.	2	14

DISTRICT VI.—STIRLING (SAUCHIE).

Perennial rye-grass is said to be uprooted by frost in this district.

No.	Age.	Altitude.	Soil.	Root-depth.	Remarks.
		Feet		Inches.	
1	Laid down, 1882.	260	Medium loam. Depth, 14 inches. Subsoil a light loam.	21	Exposure, south-east. Course of cropping—(1) white crop (1885); (2) pasture for sheep (1886) Since grazed by cattle and sheep. This field is rather full of weeds.
2	Laid down, 1877.	..	Light coloured clayey loam. Depth, 14 inches. Drained.	17	Exposure, south-east. Grazed by sheep & cattle Daisies very abundant.
3	16 years.	290	Yellow medium loam. Depth, 20 inches.	24	Exposure, south-east. Chiefly grazed by cattle; at times by horses.
4	At least 20 years.	260	Soil poorer and lighter than last. Depth, 9 inches. Subsoil, calmstone beds.	12	Exposure, south-east. Grazed only by cattle: a little cake sometimes given.
5	The same.	200	Dark loam, greasy, strongish, not sandy. Depth, 11 in. Subsoil stony, and mingled with layers of clay.	24 (13 in. in subsoil.)	Little fog in this field. Drains 3 ft. deep. Depastured by cattle, at times by sheep and horses.
6	The same.	450	Poor loamy clay. Depth, 6 in. Subsoil, clay. Drained.	15	Drained in 1868. Exposure, south-east. Valued at 15s. per acre.
7	At least 40 years old.	290	Good rich loam. Depth, 18 in. Subsoil similar, passing into clay.	24	Eastern exposure. Grazed by cattle and sheep. Value, 50s. per acre.
8	Very old.	740	Light loam, darkish in colour. Depth, 10 in. Subsoil, 2 in. Resting on rock. No drainage.	12	Exposure, south-east. Grazed by cattle and sheep.

Qualitative Analysis.

	Pastures.							
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.
Herbage								
Gramineæ—								
Perennial rye-grass	p	—	traces	—	—	—	traces	—
Crested dogstail	p	—	p	traces	p	traces	p	—
Timothy	p	—	traces	—	—	—	—	—
Cocksfoot	p	traces	—	—	—	—	—	—
Sweet vernal	p	—	p	—	p	p	p	—
Smooth-stalked meadow	—	—	—	—	—	p	p	—
Rough-stalked meadow	—	—	—	—	—	—	—	—
Sheep's fescue	p	p	p	p	p	p	p	p
Bent	p	p	p	p	p	p	p	p
Yorkshire fog	p	p	p	p	p	p	p	—
Meadow fescue	p	—	—	—	—	—	—	—
Annual meadow-grass	p	—	—	—	—	—	—	—
Wavy hair-grass	—	—	—	—	—	p	—	p
Tufted hair-grass	—	—	—	—	—	—	p	—
Brown bent	—	—	—	—	—	—	—	p
Mat-grass	—	—	—	—	—	—	—	p
Leguminosæ—								
White clover	p	p	p	p	p	p	p	—
Cow-grass	p	—	p	p	—	p	p	—
Bird's-foot trefoil	—	—	—	p	—	—	p	—
Vetchling	—	—	—	—	—	p	—	—
Compositæ—								
Yarrow	—	—	—	p	—	—	—	p
Plantagineæ—								
Rib-grass	p	p	p	—	p	p	p	—
Weeds.								
Buttercups	p	p	p	p	p	p	p	—
Chickweed	—	—	—	p	—	—	p	—
Ragweed	—	p	p	p	p	p	p	—
Cat's-ear	—	p	p	—	p	p	p	—
Daisy	p	p	p	p	p	—	—	—
Hard-head	—	—	—	—	p	—	—	—
Thistle	—	p	p	—	—	—	—	—
Groundsel	p	—	p	p	p	—	—	—
Lady's-mantle	—	p	—	p	—	—	—	—
Speedwell	—	—	p	—	—	—	—	—
Self-heal	—	p	—	p	p	—	—	—
Eye-bright	—	p	—	—	p	p	—	—
Sorrel	—	—	—	p	p	—	p	—
Rush	—	—	—	—	p	p	—	p
Nettle	p	—	—	—	—	—	—	—
Dipsacus	—	—	—	—	—	p	—	p
Tormentil	—	—	—	—	—	—	—	p
Heather	—	—	—	—	—	—	—	p

Quantitative Analysis.

Pasture No. 1.

	Area covered.
Herbage	80
Weeds	20
Total	100

The clover is abundant where the grass is closely eaten.

Percentage composition of gramineous herbage :—

	Area covered.
Perennial rye-grass	2
Crested dogstail	4
Timothy	3
Cocksfoot	4
Sweet vernal	3
Sheep's fescue	5
Bent	68
Yorkshire fog	6
Meadow fescue	5
Total	100

Pasture No. 2.

	Area covered.
Herbage	85
Weeds	15
Total	100

Clover grows well through the whole pasture.

Percentage composition of gramineous herbage :—

	Area covered.
Sheep's fescue	32
Bent	38
Yorkshire fog	29
Cocksfoot	1
Total	100

The buttercup is the most prominent weed.

Pasture No. 3.

	Area covered.
Herbage	89
Weeds	11
Total	100

The clover grows well through the whole pasture; some parts are almost entirely white clover.

Percentage composition of gramineous herbage :—

	Area covered.
Crested dogstail	12
Sweet vernal	5
Sheep's fescue	12
Bent	41
Yorkshire fog	30
Total	100

Estimated value per acre, £2, 10s.

Pasture No. 4.

	Area covered.
Herbage	97
Weeds	3
Total	100

Clover and bird's-foot trefoil are abundant in this pasture.

Percentage composition of gramineous herbage:—

	Area covered.
Sheep's fescue	69
Yorkshire fog	6
Bent	25
Total	100

Rib-grass and sorrel are specially abundant.

Pasture No. 5.

	Area covered.
Herbage	80
Weeds	20
Total	100

In certain parts of this pasture clover is specially abundant.

Percentage composition of gramineous herbage:—

	Area covered.
Crested dogstail	21
Sweet vernal	6
Sheep's fescue	10
Bent	30
Yorkshire fog	33
Total	100

Pasture No. 6.

	Area covered.
Herbage	77
Weeds	23
Total	100

There is a fair proportion of clover through the whole pasture.

Percentage composition of gramineous herbage:—

	Area covered.
Sweet vernal	2
Sheep's fescue	70
Bent	17
Yorkshire fog	3
Wavy hair-grass	5
Smooth-stalked meadow	3
Total	100

Pasture No. 7.

	Area covered.
Herbage	88
Weeds	12
Total . .	100

Clover is very luxuriant in this field.

Percentage composition of gramineous herbage:—

	Area covered.
Crested dogstail	6
Sweet vernal	6
Smooth-stalked meadow . . .	4
Sheep's fescue	56
Bent	20
Yorkshire fog	6
Tufted hair-grass	2
Total . .	100

Pasture No. 8.

	Area covered.
Herbage	60
Weeds (mainly tormentil and heather) .	40
Total . .	100

Percentage composition of gramineous herbage:—

	Area covered.
Sheep's fescue	60
Bent	5
Wavy hair-grass	20
Brown bent	10
Mat-grass	5
Total . .	100

Yarrow is very abundant, but was scarcely observable outside the enclosed plot, because it was eaten so closely down by the stock.

WEIGHT OF PRODUCE PER ACRE.

	Green.		Dry.	
Pasture.	Tons.	Cwt.	Tons.	Cwt.
No. 1 . .	6	14	1	16
" 2 . .	12	14	3	6
" 3 . .	15	10	3	2
" 4 . .	8	16	2	2
" 5 . .	14	18	2	18
" 6 . .	6	8	1	16
" 7 . .	10	12	3	1
" 8 . .	8	4	2	12

DISTRICT VII.—LAUDERDALE (BOON).

Name.	Age.	Altitude.	Soil.	Remarks.
		Ft.		
New lambing-field.	Laid down, 1882	720	Soil, clay loam. Subsoil, boulder clay.	
Old cow-field.	Laid down, 1880	..	..	
Houses field.	Laid down, 1878	800	..	Limed in 1873.
Old lambing-field.	Laid down, 1874	700	Soil, clay loam. Subsoil, boulder clay.	Exposure, south.

QUALITATIVE ANALYSIS.

	Pastures.			
	No. 1.	No. 2.	No. 3.	No. 4.
HERBAGE.				
Gramineæ—				
Perennial rye-grass	p	p	p	p
Meadow fescue	—	traces	—	—
Crested dogstail	p	p	p	p
Timothy	p	p	traces	p
Cocksfoot	p	p	p	p
Sweet vernal	p	p	—	—
Smooth-stalked meadow	p	traces	p	p
Rough-stalked meadow	p	traces	p	p
Sheep's fescue	p	traces	p	p
Bent	p	p	p	p
Yorkshire fog	p	p	p	p
Meadow foxtail	—	p	—	—
Leguminosæ—				
White clover	p	p	p	p
Cow-grass	—	—	—	p
Plantagineæ—				
Rib-grass	p	p	p	p
Compositæ—				
Yarrow	—	—	—	—
WEEDS.				
Buttercups	p	p	p	p
Silver-weed	p	p	p	p
Self-heal	p	p	p	p
Thistle	p	p	p	p
Daisy	p	p	p	p
Bartsia	p	p	p	p
Crepis	—	—	—	p

QUANTITATIVE ANALYSIS.

Pasture No. 1.

	Area covered.
Herbage	92
Weeds	8
Total	100

		Area covered.
Herbage	Gramineous	80
	Leguminous	20
	Total	100

Percentage composition of gramineous herbage:—

	Area covered.
Perennial rye-grass	4
Crested dogstail	25
Timothy	3
Cocksfoot	12
Sweet vernal	3
Smooth-stalked meadow Rough-stalked meadow	21
Sheep's fescue	5
Bent	19
Yorkshire fog	8
Total	100

Pasture No. 2.

	Area covered.
Herbage	97
Weeds	3
Total	100

		Area covered.
Herbage	Gramineous	84
	Leguminous	16
	Total	100

Percentage composition of gramineous herbage:—

	Area covered.
Perennial rye-grass	9
Crested dogstail	17
Timothy	11
Cocksfoot	10
Sweet vernal	3
Smooth-stalked meadow Rough-stalked meadow	2
Sheep's fescue	3
Bent	23
Yorkshire fog	20
Meadow foxtail	2
Total	100

Pasture No. 3.

	Area covered.
Herbage	96
Weeds	4
Total	100

		Area covered.
Herbage	Gramineous	67
	Leguminous	33
	Total	100

Percentage composition of gramineous herbage:—

	Area covered.
Perennial rye-grass	15
Crested dogstail	45
Cocksfoot	8
Smooth-stalked meadow Rough-stalked meadow	8
Sheep's fescue	2
Bent	11
Yorkshire fog	11
Total	100

Pasture No. 4.

	Area covered.
Herbage	95
Weeds	5
Total	100

		Area covered.
Herbage	Gramineous	67
	Leguminous	33
	Total	100

Percentage composition of gramineous herbage:—

	Area covered.
Perennial rye-grass	30
Crested dogstail	21
Timothy	4
Cocksfoot	8
Smooth-stalked meadow Rough-stalked meadow	5
Sheep's fescue	10
Bent	12
Yorkshire fog	10
Total	100

DISTRICT VIII.—KIRKCUDBRIGHT (HOWELL).

Age.	Altitude.	Soil.	Root-depth.	Remark
	Ft.		In.	
Very old.	80	Rich brown loam. Depth, 16 inches.	20	
Very old.		Reddish loam. Depth, 15 inches.	19	
Very old.		Depth, 14 inches.	12	

QUALITATIVE ANALYSIS.

HERBAGE.	HERBAGE—*continued.*	WEEDS.
Gramineæ—	*Gramineæ*—continued.	Buttercups.
Perennial rye-grass.	Bent.	Sorrel.
Cocksfoot.	Sweet vernal.	Chickweed.
Timothy.	Couch-grass.	Anthriscus.
Meadow foxtail.	*Leguminosæ*—	Cow-parsnip.
Smooth-stalked meadow.	White clover.	Dandelion.
	Bird's-foot trefoil.	Thistle.
Rough-stalked meadow.	*Compositæ*—	Rag-weed.
Meadow fescue.	Yarrow.	Hard-head.
Sheep's fescue.	*Plantagineæ*—	Lady's-bedstraw.
Yorkshire fog.	Rib-grass.	Nettle.

This pasture contains the above plants, but its full quantitative analysis requires further study. Perennial rye-grass is here undoubtedly old, and no better example of this point can be found in Scotland.

The root-depth of the grasses in these excellent pastures is at some places extraordinary. Mr Dudgeon states that he measured the depth in one place, and found it to be 42 inches.

CONCLUSION.

That root-depth and depth of soil are important factors in laying down land to grass is self-evident, when it is borne in mind that the farmer wishes to use the land at disposal as completely and advantageously as possible. Assuredly this is not accomplished if a certain depth of soil is left unoccupied for a long series of years. In such a case, not only is a portion of the land left idle, but the layers in actual use are injuriously affected by the unoccupied substratum. The data regarding root-depth may serve as a guide to the more perfect and complete utilisation of the land under grass.

A glance at the quantitative analyses ought to convince any one that nature has, too often, been allowed to run riot with our pastures. In such circumstances, it is sheer folly for the agriculturist to expect the maximum amount of the most valuable produce from his land. To attain this result, the practical man must adopt ways and means whereby nature may be made subservient to his purpose. That is to be accomplished by taking care that the land is stocked with suitable and permanent plants, which, when put in possession, prevent worthless indigenous species from overrunning the pasture, and defeating, to a very large extent, the object which the farmer has in view.

The investigations during the present year will deal with the following points:—

1. The most advantageous proportion of clover to grass.
2. The causes which retard or favour the growth of clover.
3. The causes which have led to pasture deterioration.
4. The means whereby pastures may be improved.

FRUIT-FARMING.

By Cecil H. Hooper, F.H.A.S., of the Horticultural College, Swanley, Kent.

The possibility of the Extension of remunerative Fruit-farming in Scotland.

The production of fruit is confined to a smaller area than that of corn, meat, or milk, and at present yields better prices. Scotland can supply the south with late fruits, which command more remunerative returns than when the markets are crowded with fruit.

Necessary Considerations before commencing Fruit-growing.

These include the consideration of climate, situation, soil, available labour and manure, market facilities and capital.

Climate.—Climate governs the varieties of fruit suitable for profitable cultivation.

Most of Scotland is suited to strawberries, gooseberries, and currants. Early strawberries are grown in Ayrshire, Bute, and East Lothian; late strawberries in Perthshire, Aberdeenshire, and Forfarshire. Currants and gooseberries are grown largely in the valley of the Clyde.

Apples and pears generally thrive better in the east than in the west of Scotland, probably because there is less rain. They thrive in the Lothians, Perthshire, and especially in the Carse of Gowrie, and also in Ross and Kincardine.

Plums bear well if their blossoms are not injured by late frost and cold wind.

The Morello cherry does well especially on short stems; other cherries are not generally suitable except on walls, which are also well suited to the growth of pears.

The wild plants are a guide as to what fruits are suited to any particular locality. Thus, the wild strawberry, blackberry, sloe, hawthorn, or hazel, if fruiting well, would indicate that strawberry, raspberry, plum, apple, and nut might do the same. Altitude influences the climate and vegetation greatly.

Situation.—Fruits require sun and air. Shelter from strong winds is advantageous, especially north and east; whilst undrained land and damp valleys from which mist rises, are unfavourable, as blossoms moistened by mist are liable to be ruptured by frost. Unless the slope is considerable, aspect is of secondary importance.

Soil.—Fruits have their preferences as to soil in the same way as other crops; but most fruits will thrive best on deep, rich, and well-drained land, though there are few soils but will grow some variety of fruit.

Labour.—Fruit-farming requires more labour than ordinary agriculture, whilst pruning, manuring, and digging give much employment during winter. Much of this work requires skill and knowledge, tending to elevate the labourer and make him more content with country life. In picking the fruit, men, women, boys, and girls are largely employed.

Manure.—Good fruit-cultivation demands considerable outlay in manure. Stable manure is obtained from the towns by rail and road; of other natural manures we have Peruvian guano, herring, cod, bones, hoofs, horns, fur and animal waste, woollen rags and hair, together with lime and soot, which are specially useful in preventing injury from slugs and caterpillars. Mineral and other manufactured manures are not generally used for fruit; but judiciously employed, might be advantageous in supplying the elements of plant-food which are deficient in the soil, as they are easily applied, and afford very little shelter to insects.

Market.—The distance from market decides what crops to grow. Strawberries and raspberries must be delivered at market as soon as possible, or their freshness is lost. Red and black currants, if much shaken, lose their juice by the pressure of their own weight. Plums and ripe gooseberries travel fairly well; hard green gooseberries travel well in sacks. Apples travel and keep well. Pears vary much in character, and require treatment accordingly.

Capital.—Fruit-farming needs a larger capital than ordinary agriculture. The cost of preparation, planting, and cultivation, until there is remunerative return, varies with the fruit—from £35 per acre and upwards; whilst the working capital to stock a fruit-farm already planted is £20 per acre and upwards.

Fruit-planting by the Landlord, by the Tenant, and by the Landlord and Tenant jointly.

Fruit-farming affords the *landowner* an interesting and remunerative system of farming on suitable land, by which he enhances the value of the land both for himself and his heirs; and there is scope for planting land with fruit, and subdividing it into allotments.

Most of the farms in Canada and United States have each their apple-orchard, which is very valuable to them. Orchard-planting on farms, and planting cottage-gardens, would afford an attraction and a better rent.

If the *tenant* wishes to plant fruit, he requires as securities the written consent of his landlord to compensate him; or he may plant on his own responsibility, if he has a long lease, as the law does not permit the removal of fruit bushes or trees.

For compensation, an arbitrator is generally employed to estimate the value of the improvement. This he will determine on the present condition of the fruit-plants, and the cultivation of the land, taking into consideration the probable length of life of the plant, and the period of greatest fruitfulness. To give some idea of these points, I have prepared the following table (the bushes being taken as two years old, and the trees as having been grafted or budded two years when planted):—

In Scotland.

Approximate.	Life of the Plant.	Commencement of remunerative return.	Period of best production.	Yield per acre.	Price per ton, 1889.			Gross return per acre.		
	Years.	Year.	Year.	Tons.	£	s.	d.	£	s.	d.
Strawberry . .	5	2d	3d	2 to 5	21	0	0	42	0	0
Raspberry . .	10	3d	6th	3 to 4	23	0	0	70	0	0
Gooseberry . .	12	4th	7th	3	8	10	0	25	0	0
Red currant .	15	3d	7th	2	15	0	0	30	0	0
Black currant .	15	3d	7th	3 to 4	25	0	0	75	0	0
Plum (standard)	40	10th	15th	7	16	0	0	112	0	0
Cherry "	40	10th	15th	4	25	0	0	100	0	0
Apple "	50	7th	15th	6	10	0	0	60	0	0
Pear "	50	12th	20th	2	10	0	0	20	0	0
Apple (dwarf) .	20	5th	18th	...	...			...		
Pear " .	20	5th	10th	...	...			..		
Plum " .	20	10th	12th	...	...			...		
Cherry " .	20	7th	12th	...	...			...		

If the *landlord and tenant share the expense of planting,* the general arrangement is for the landlord to supply the trees, and the tenant to plant them. I have heard of one case in which the tenant is to plant and pay all expenses, and if he leaves within three years, rent, rates, and cost of planting are to be repaid.

Preparations for Fruit-planting.

There must be a roadway to and from the fruit-plantation for the conveyance of the fruit and manure. If protection is needed, a good fence is made with posts or railway-sleepers and five to eight strands of barbed wire.

A shed or tent for packing is desirable; and if it is intended to preserve the fruit by bottling or jam-making, any shed or barn can be fitted up for this purpose without great expense. This renders the owner less dependent on the market, and he can decrease the labour of preserving during fruit-picking time by boiling his fruit and placing it in sterilised casks, to be sent to the jam manufacturer, or to be made up when there is more leisure.

It is very important to have the land free from weeds, as these are difficult to eradicate when the plantation is once started. It should be stirred deeply, and if a sufficient area is to be planted, running the steam-cultivator deeply through the land lengthway and breadthway to the field is excellent, as it leaves the soil in its natural position, and is preferable to very deep ploughing, which may bring up inferior soil to the surface, and bury the manure too deeply. Manure is generally applied in large quantities (even 50 tons per acre); this retains moisture, as well as nourishes the plant. It is carted and spread upon the land more readily before the latter is worked. Some fruit-growers do not manure the land before planting, but afterwards top-dress the soil over the roots.

COST PER ACRE OF PREPARING LAND FOR FRUIT-PLANTING.

Manure, 40 tons, at 3s. 9d. per ton . .	£7 10 0	
Cartage from station and depositing in heaps, at 3s. 9d. per ton . . .	7 10 0	
Spreading manure	0 3 0	
		£15 3 0
Ploughing	. .	0 15 0
Steam-cultivation by grubber twice over, crossways, 18 inches deep . .	£1 0 0	
1 cwt. coal per acre	0 2 0	
Cartage of coal and water . . .	0 1 0	
		1 3 0
Harrowing twice each way . . .	. .	0 3 0
		£17 4 0

If the area is too small for steam-cultivation, trenching with a wide trench to allow the lower soil to be replaced in position, with top soil over it, will be the best method.

COST PER ACRE.

Manuring with 40 tons	£15 0 0
Trenching	12 0 0
	£27 0 0

The land is levelled by the harrow, which is specially required for strawberry-growing.

The best time for planting fruit trees and bushes is immediately after the leaf has fallen.

I will now give details as to cultivation of the different fruits individually.

Field-cultivation of the Strawberry.

The Sir Joseph Paxton variety is commonly grown in the south. The runners are taken from a patch of strong plants, one or two years old; when these are well rooted at the end of August, they are detached from the parent plant with the pruning-knife, and left in the ground till spring. The land is manured and kept stirred during the winter, in order to get a good tilth. In March the land is rolled and marked out in lines from 30 to 34 inches apart. The runners are raised by fork, trimmed, and planted as soon as possible with a dibble, 14 to 20 inches apart. The soil is placed well against the root, and the land may be rolled to make it firm. During the first season, the runners are trimmed off with a sickle almost every week, and the land is hand and horse hoed alternately about four times. The crop the first season is very small; those that are picked require to be washed. On wet land a double mould-board plough is run up between the rows to form a drain and to throw up furrows, which help to protect the plants from frost. No manure is applied the first winter; but when the plants are in bloom, the land is hand-hoed, and immediately after is littered over with barley-straw (which has lost its awns, as the latter would stick into the fruit). Oat-straw may be used—wheat-straw is rather hard and stiff; the best and softest is straw that has been once used and raked off. If the plants are weak, stable litter is shot down at the end of each row, and conveyed between the rows with wheel-barrows to be littered about by hand. Before picking-time rain will have cleansed the litter and conveyed nourishment to the plants.

Picking costs 3d. to 5d. for 12 lbs. The yield of fruit is about 2 tons per acre, averaging 2d. per lb. wholesale. The earliest and finest fruits are put into punnets, but when the price lowers, into peck-baskets. The fruit is picked each second or third day during the three or four weeks of fruiting. Immediately after gathering, the straw is raked together and cleared away; the runners and old leaves are trimmed off; then the horse-brake goes down between the rows, and the ground is hand-hoed between the plants. If nourishment is needed, short manure, such as peat manure, is forked in between the rows, and the same work as in the previous year is repeated. The plants are usually picked for three seasons; only, as the size and yield of fruit decrease with age, they are ploughed up, and other crops grown for a few years—such as Brussels sprouts, potatoes, or peas—after which strawberries may be replanted; but on some land strawberries do not thrive well again unless a long interval has elapsed.

Strawberries planted after grass are very liable to be severely attacked by wireworms and slugs; such land, therefore, will require much working before planting. Strawberries thrive best of all on grubbed-up woodland: they are also well suited to sewage-farming.

Cost per Acre of Planting and First Year's Cultivation.

Oct.	Manuring with 40 tons . . .	£15 3 0	
	Preparation of land	2 1 0	
March.	Marking out land by marking-machine	0 2 0	
			£17 6 0
	10,560 strawberry plants, at 5s. per 1000	£2 12 9	
March.	Dibbling in plants 33 inches by 18 inches apart . . .	0 15 0	
			3 7 9
May to Oct.	Cutting off runners four or five times	£0 10 0	
	Horse-hoeing four or five times, at 3s., 4 acres a-day . . .	0 15 0	
	Hand-hoeing three or four times, at 4s..	0 16 0	
July.	Picking and packing, and sale of 10 pecks strawberries . .	0 8 0	
Oct.	Digging	1 5 0	
March.	Horse-hoeing three or four times, at 3s.	0 12 0	
	Hand-hoeing three or four times, at 4s.	0 16 0	
June.	Hand-hoeing when in bloom .	0 4 0	
	1½ load of barley-straw, at 31s. per load	2 6 0	
	Carting out and littering straw over plants	0 10 0	
			8 2 0
June and July.	Picking and packing 2 tons at 5d. for 12 lb.	£7 15 0	
	Carriage of 2 tons at, say, 16s. .	1 12 0	
	Carry forward .	£9 7 0	£28 15 9

Brought forward .	£9 7 0	£28 15 9
Market toll and salesman's commission on 375 pecks (12 lb.), at 3d.	4 13 9	
		14 0 9
Rent, rates, taxes, for one and a half years .		3 0 0
Total cost . . .		£45 16 6
Receipt—first year, 120 lb., at 2d. .	£1 0 0	
Second year, 2 tons, at £21	42 0 0	
		43 0 0
Deficit balance to be made up by the spread of first costs on the crops of following years .		£2 16 6

ANNUAL COST OF CULTIVATION PER ACRE.

Aug.	Cutting off runners after picking .	£0 7 0	
	Raking up and clearing off litter and runners costs 12s.; the value of the straw being about 15s.		
	Horse-hoeing once, 4s.; hand-hoeing once, 6s.; or forking between roots, 10s.	0 10 0	
Oct.	Digging	1 5 0	
March to June.	Horse-hoeing and hand-hoeing, three times each	1 4 0	
April.	Forking out couch-grass . . .	0 2 0	
June.	Hand-hoeing when in bloom . .	0 4 0	
	Twelve carts of stable litter, at 3s. .	1 16 0	
	Carted and dropped in heaps, spread by men, and placed under the leaves by women	0 15 0	
July.	Picking and packing 2 tons, at 5d. per 12 lb.	7 15 0	
	Carriage, 2 tons, at, say, 16s. per ton .	1 12 0	
	Market toll and salesman's charges, 375 pecks (12 lb.), at 3d.	4 13 9	
	Rent, rates, and taxes	2 0 0	
	Cost . .		£22 3 9
	Balance for superintendence, unforeseen expenses, interest on capital, and proportionate cost of planting and profit		19 16 3
	Receipt—2 tons of strawberries, at £21 . . .		£42 0 0

Raspberry Cultivation.

The land is manured and ploughed, holes are dug 15 inches apart in each fifth furrow, the young plants are dug out from a raspberry field and carefully planted. Every winter the rows are either dug or ploughed with a turn-wrist plough (*i.e.*, a plough with a mould-board, that by changing sides turns a furrow either to the right or left), which throws a furrow against each line of canes. The manure is carried about in large boxes with handles like those of a stretcher. As soon as the leaf has fallen, the old and weak canes are cut out, a few strong canes are left, which are shortened to about 2 feet from the ground, and young plants which have strayed into the rows are dug up, and can be used for planting new land. During the season the plantations are horse-hoed about four times and hand-hoed three times, the former costing about 3s. per acre, the latter 4s. or 5s. per acre each time. Falstaff, Carter's Prolific, and Norwich Wonder are well suited for this cultivation, being good bearers, and the canes standing up well without support.

Raspberries are largely sent to market in tubs to preserve the juice.

COST PER ACRE OF PLANTING AND FIRST SEASON'S CULTIVATION.

Oct.	Manuring with 30 tons	£12 7 0	
	Ploughing	1 0 0	
			£13 7 0
Feb.	17,424 young raspberry plants, at £1 per 1000	£17 8 6	
	Heading off the canes 1 foot high	0 6 0	
	Digging 8712 holes, rows in each fifth furrow (4 feet) 15 inches apart, plants carried by a woman, two planted in each hole	2 0 0	
			19 14 6
March to July.	Horse-hoeing 4 or 5 times, at 3s.	£0 15 0	
	Hand-hoeing 4 to 5 times, at 5s. to 6s.	1 10 0	
			2 5 0
	Picking raspberries, 4 cwt., at 4s.	£0 16 0	
	Packing, carriage, and sale charges	0 14 0	
			1 10 0
	Rent, rates, taxes		2 0 0
			£38 16 6

COST PER ACRE ANNUAL CULTIVATION OF THE RASPBERRY.

Nov.	Cutting out old and weak canes, 5s.; tying and carrying out prunings, 1s.; withs, 1s.	£0 7 0	
	Manuring with 1 ton fur-waste	5 0 0	
	Digging between the rows with spade (or ploughing)	1 0 0	
March.	Cutting canes to 2½ feet high	0 3 0	
April.	Forking out couch-grass	0 2 0	
April to	Horse-hoeing 5 times	0 15 0	
Oct.	Hand-hoeing 5 times	1 10 0	
			£8 17 0
July.	Picking 2 tons raspberries, and packing into peck-baskets or tubs, at £4	£8 0 0	
	Carriage of 2 tons, at, say, 16s.	1 12 0	
	Carry forward	£9 12 0	£8 17 0

Brought forward	£9 12 0	£8 17 0
Market toll and salesman's charges, 10 per cent on £46	4 12 0	
		14 4 0
Rents, rates, taxes		2 0 0
Cost		£25 1 0
Balance for unforeseen expenses, superintendence, interest on capital, proportionate cost of planting		20 19 0
Receipt—2 tons, at £23		£46 0 0

Planting of Fruit Trees and Bushes.

Fruit trees and bushes should be allowed room for the extension of their roots, and should be planted at sufficient distance apart to give them full benefit of the sun and air.

Apples are planted 18 to 30 feet apart, plum-trees 12 feet and upwards, and the bush fruits 5 or 6 feet apart, the distance depending on the varieties and surrounding conditions.

Stations for trees in grass should be 6 feet across, and the soil stirred to a depth of 2 feet.

In a district new to fruit-farming, local gardens should be studied to ascertain what fruit thrives best. A reliable nurseryman, especially if acquainted with the district, might be consulted. If a large area is to be planted, a trial ground would yield valuable information.

Well-grown trees and bushes of a limited number of varieties suited to market-growth and guaranteed true to name, should be bought of a reliable nurseryman. These should be planted in groups of the same variety for convenience in picking: the distance apart of the trees and bushes should be governed by their natural habits; a quincunx or diagonal arrangement will allow the most space to each plant. Standard trees should be staked; it is best to place the stake in the ground when the tree is put in position before earthing in, as by this means injury to the roots is avoided. In tying the tree, any chance of cutting the tree by the string should be avoided by bandaging the tree with cloth or straw.

A plan should be made of the land planted, indicating the different varieties of fruit, and the trees themselves should be labelled with the name or reference number.

Gooseberry, Red and Black Currant Plantations.

When these fruits are planted alone, the distance between the bushes is about 6 feet, but it depends on the variety grown. During winter these plantations are pruned, manured, and dug by spade if land is not stony, in which case it is dug by a fork with three or four broad tines; during summer the plantation is hand-hoed three or four times—the first hoeing costing 10s., the others 6s. or 7s. per acre.

COST PER ACRE OF PLANTING AND FIRST YEAR'S CULTIVATION.

		£	s.	d.
Autumn.	Manuring with 40 tons	£15	3	0
	Ploughing and cultivating, four harrowings	2	1	0
	Marking out for planting in two directions	0	3	0
Nov.	1452 currant-bushes at 6s. per 100	4	7	0
	*1452 gooseberry-bushes, at 8s. per 100, £5, 16s. 2d.			
	Digging 1452 holes 1 foot square, woman carrying bushes, man planting bushes, 1s. 8d. per 100	1	4	2
April to	Horse-hoeing four times, at 3s.	0	12	0
Sept.	Hand-hoeing four times, at 5s.	1	0	0
June.	Picking half-bushel green gooseberries	0	1	0
	Rent, rates, taxes	2	0	0
		£26	11	2
	* Gooseberry	27	0	4

SECOND YEAR'S CULTIVATION.

		£	s.	d.
Oct.	Pruning gooseberry-bushes, taking out cross branches	£0	3	0
Nov.	Digging with spade, £1 to	1	5	0
April to	Horse-hoeing five times, at 3s.	0	15	0
Oct.	Hand-hoeing six times	1	10	0
June.	Picking 6 half-bushels green gooseberries, at 6d.	0	3	0
	Packing and splints, ½d. per half-bushel	0	0	3
	Carriage and sale	0	2	0
	Rent, rates, taxes	2	0	0
		£6	18	3

COST PER ACRE OF ANNUAL CULTIVATION WHEN MATURE.

		Black Currant.	Red Currant.	Gooseberry.
Oct.	Pruning	£0 18 0	£1 2 0	£1 5 0
	Clearing cuttings	0 5 0	0 5 0	0 5 0
Nov.	Each alternate year, 20 tons manure, with cartage, £6, 15s.; wheeling, 12s.; spreading, 3s. = £7, 10s. Half of	3 15 0	3 15 0	3 15 0
	Digging with spade	1 0 0	1 0 0	1 0 0
April to Sept.	Hand-hoeing four times	1 8 0	1 8 0	1 8 0
Aug.	Picking 2 tons black currant, at 1s. per 28 lb.	8 0 0	...	...
	Picking 2 tons red currant, at 6d. per 28 lb.	...	4 0 0	...
	Carry forward	£15 6 0	£11 10 0	£7 13 0

Brought forward	£15 6 0	£11 10 0	£7 13 0
Picking 3 tons gooseberries, at 5d. per 28 lb.	...	...	5 2 0
Packing, at 2s. per 100 half-bushels	0 3 2	0 3 2	0 4 10
Carriage, 16s. per ton	1 12 0	1 12 0	2 2 0
Toll, ½d.; sale, 3d. per half-bushel	2 6 8	2 6 8	3 10 0
Rents, rates, taxes	2 0 0	2 0 0	2 0 0
Cost	£21 7 10	£17 11 10	£20 11 10
Balance—for unforeseen expenses, superintendence, interest, cost of planting, profit	£12 12 2	£6 8 2	£4 18 2
Receipt—2 tons black currant, at £17	£34 0 0	...	...
2 tons red currant, at £12	...	£24 0 0	...
3 tons gooseberry, at £8, 10s.	...	...	£25 10 0

Mixed Plantations.

Strawberry, raspberry, red and black currants, and gooseberry, are grown with apple, plum, and pear trees, usually half-standards, over them. These plantations are frequently surrounded by damson or bullace plums, which are very certain bearers: when these trees get tall, the branches are headed off about one foot from the branching point, from which stumps productive young wood springs.

In order to give the greatest space, the trees are planted in the rows diagonally, to form triangles rather than squares with one another.

I will quote four existing examples of combinations, but in the case of the apples the distance is considered insufficient, and would be better at 22 feet apart.

No. 1.—Standard apple-trees are planted 16½ feet apart each way, with two rows of gooseberries between the apple lines, and one row in the same line as the apple-trees, the gooseberries being 5½ feet apart each way.

No. 2.—Standard apple-trees 16½ feet apart each way, with three rows of raspberries between the lines of apples, and one in the apple line, the rows being 4 feet apart, and the plants in each row 15 inches apart.

No. 3.—Half-standard plum-trees 16½ feet apart each way, two rows of currants between, and one row in the line of plums, 5½ feet apart, with six rows of strawberries 2 feet 9 inches apart, the plants being 14 inches apart; thus one row of strawberries is in the currant and plum line, two rows are in the currants, and three rows alone between the currants.

No. 4.—Apple and plum half-standard trees 16½ feet apart, one nut-bush between each apple and plum tree in the line, two rows of black currants between the rows of trees 5½ feet apart. Violets are sometimes grown between the rows, and in one place narcissi are planted in the same line as the currant-bushes.

Cultivation of Mixed Plantations.

The plantations are hoed about five times in the year. Green gooseberries are first ready for picking, then follow strawberries, raspberries, red and black currants, plums, damsons, apples, and nuts. The picking is mostly paid for by measure. Winter cultivation begins with pruning, manuring, and digging with the spade or fork.

Pruning.

When the leaf has fallen pruning begins, the aim of which is to encourage fruit production by giving the best shape to the trees and bushes for the admission of sun and air. The implements used are saws, pruning-knives, short and long handled pruning-scissors, all well sharpened. A knife leaves the smoothest and most readily healed wound: the cut should, if possible, be made just above a bud which has an outward direction, so that the young shoot may extend outwards.

With *black currants* which produce their fruit on the young shoots, the older wood is cut out, and plenty of room left for the strong young shoots to develop themselves.

In *red currants,* which usually stand on a short stem, with five or six branches extending outwards, the fruit is produced at the junction of the old branch with the young lateral shoots, which are cut off about one inch from the old branch, and the end of each branch topped to increase the vigour of the lateral shoots. In order to replace old branches, young shoots in good positions are left, being topped to encourage side shoots. In the case of *apple-trees,* dead wood and branches that rub one another, thereby encouraging canker, are sawn off, and superfluous twigs cut out from branches with thick broomy extremities.

Plum-trees should also have their dead and superfluous wood cut out.

The pruned-off wood is collected, faggoted, tied in bundles, carted away from the fruit plantation, and stacked for firewood. The cuttings from the bushes are tied with string and removed from the plantation, as they harbour insects, &c., injurious to fruit plants; they are used as fuel by the pickers.

Gooseberry pruning is often left until rather late in the pruning season, as a certain amount of protection against birds taking the buds is afforded by the numerous twigs and thorns. In some cases white cotton is stretched from twig to twig to keep birds away, or soot may be sown over them.

The fruit is produced principally upon the young wood, but also upon spurs from the old wood. The oldest wood is cut out, and the bush is kept open by cutting out branches that cross it, and those that bend downwards are shortened. During the winter the *seedlings and suckers of the plums* are removed, and if more plum-trees are required, the seedlings and suckers may be planted in the nursery. From the *nut-bushes* the "wands," which are strong upright shoots from the branches of the bushes, are extracted with a sharp pull outwards and downwards, and are subsequently used for "splints" in packing the baskets of fruit. After the pollen of the nut catkins has been carried by the wind to the little red stigmas of the nut blossoms, the interior is kept open, the leading shoots are shortened to three buds, and the lateral spray tipped.

Cost of pruning per acre varies with the distance apart, age, and previous treatment of the plants. Prices in West Kent are roughly per acre:—

	1st year.	2d year.	3d year.		
Black currant	2s.	3s.	5s. ;	after six years	12s. to 18s.
Red currant	2s. 6d.	3s.	7s. ;	after seven years	18s. to 25s.
Gooseberry	2s. 6d.	5s.	10s. ;	after ten years	20s. to 25s.
Collecting and clearing cuttings off ground . .					4s. to 5s.
Nut-bushes, clearing out "wands" and grubbing up spawn					5s.
Standard trees, yearly pruning					3s. to 6s.
Nut-bushes, cutting young shoots per hundred . .					8s. to 15s.

Manuring and Digging.

Town or farmyard manure is put on at the rate of about thirty tons per acre, being carried in baskets or by wheelbarrows, and spread either round the trees or over the whole surface (cost, 10s. to 15s. per acre). The plantation is lightly forked near the trees and bushes, and deeply in the middle of the row; this digging costs from 20s. to 25s., and on very stiff land 30s. per acre.

Moss and lichen growing on fruit-trees are injurious, as they harbour insects, &c.; to remove them the bark of the trunk and bases of the branches are scraped with hoop-iron, and washed with quicklime and a little sulphur mixed with water, and put on with a tar-brush. In order to clear the heads of the trees from lichen, slaked lime is thrown amongst the branches when the trees are leafless and moist with dew or rain. In order *to prevent the ascent of leaf-eating insects* up the trees in autumn and winter to lay their eggs, early in the autumn sticky preparations, such as Stockholm tar and cart-grease, are applied in a ring round the trunk about 1½ foot above the ground, either directly to the tree or on a straw band, or on a piece of brown paper tied round the tree. The latter plans are preferable, as young plums may be injured by direct application.

When bearing much fruit, the branches of plum-trees require propping with bandaged forks, otherwise the branches are liable to be broken.

Plantation of Dwarf, Bush, and Pyramid Trees.

The cultivation of dwarf, bush, and pyramid trees forms an interesting and remunerative branch of fruit-growing, and is likely to become very popular. The cost per acre for preparation and planting may be £60 if well done, as the trees are planted closer than standard trees, or £65 with currants or gooseberries between. Apple, pear, and plum, grafted or budded on their respective dwarfing stocks, yield fruit of fine size and quality at an earlier age than standard trees. The form and size of the tree render pruning and picking easier, and there is less risk of the fruit being blown down. Broad-step ladders are employed for pruning and picking the larger trees.

The trees are planted from 4 to 12 feet apart: the distance depends on whether intermediate trees are to be removed to give space, whether there is intermediate cropping of fruit, flowers, or vegetables—and on the nature of the soil and kind of fruit grown. In some cases (especially on wet lands) the trees are planted almost on the surface, with a mound of earth round the roots, after the soil has been well moved underneath and around. A ring of manure is usually put over the roots to prevent drought, and to nourish, warm, and encourage the roots to come near the surface, where they receive warmth from the sun and make most use of the manure.

Strawberries, bush fruits, flowers, and vegetables may be grown between the trees, if well manured and cultivated; standard trees are also frequently planted with the dwarf trees.

Summer pruning is very advantageous to these trees, giving them good form for fruit production; if the wood becomes too luxuriant, the trees are root-pruned by tying the branches out of one's way, and digging a ring round the tree about 2 feet deep, cutting away all thick roots, and then, especially in the case of pear, tunnelling under the centre of the tree to cut away the tap-root if one is found.

Cordon trees.—In the Channel Islands, where especially fine pears are produced, the fruit is grown on cordons, or single stems, trained at a slope of 45° (to equalise the nourishment afforded by the sap); the shoots are kept in close to the stem, which enables the production and ripening of much fine fruit on a small area. (At the Horticultural College we have planted a large number both on wired walls and wire espaliers.)

Planting and Management of Fruit Trees on Grass Land.

Apple and pear trees are frequently planted on pasture: holes are dug 4 feet or more across to allow for root extension, and the ground is stirred 2 feet deep; if the soil is inferior, leaf-mould or other good earth is substituted for the inferior removed soil. The tap-roots and any injured roots are cut off. The trees are planted no deeper than they stood in the nursery; the roots are carefully spread out, intermixed and covered in firmly with soil; the stake is best placed between the roots before the earth is filled in; the trunk is bandaged so as to prevent chafing or cutting by the string. Triangular fences creosoted or tarred (cost, 3s. or 4s. each), or furze and thorn bushes, or galvanised wire-netting, are put round the trees to prevent the rubbing of the sheep or pigs; unless the branches are high up, cattle and horses are excluded from the orchard. Manure placed on the surface round the tree will nourish the roots and retain moisture.

To preserve the trunks from rabbits in some parts of America, strips of old rags or guano bags are tied round the trunk, whilst in Australia the tree-trunks are smeared with blood.

Trees grow fastest where the land is cultivated and kept free from weeds for the first few years, but afterwards the land may be sown with grass seeds. Grass orchards should be kept closely grazed, and in order to manure them, the sheep may be fed with cake and corn. The land, if mown, should be manured every year.

COST OF PLANTING AND PROTECTING CHERRY AND APPLE TREES ON PASTURE.

Forty-eight five-year-old trees, at 2s. 6d. (trees 30 feet apart)	£6	0	0
Digging forty-eight holes 4 feet by 4 feet, at 4d.; stirring 2 feet deep	1	1	0
Planting forty-three trees	0	5	0
Forty-eight stakes at 6s. per 100; straw and string, 1s.; staking, 3s. per 100	0	5	0
Forty-eight triangular fences to keep cattle and horses from trees, 3s. each	7	4	0
Manuring round trees with four forks full of manure on surface of soil	0	5	0
	£15	0	0

To protect trees from sheep, use wire-netting 1 yard, cut in 1-foot lengths, placed round the trees, fastened to the stake with wire staples, the ends of the wires cut off and bent outwards: this warns the sheep to keep clear. Such protection will render the trees safe from sheep and rabbits for years.

The Fruit-farm Nursery.

When once the fruit-farm is established with good fruit trees and bushes, one may propagate from these to extend the cultivation. Strawberries are multiplied from the runners produced by the plant, and raspberries are multiplied by digging out young plants from the old plantations.

Red and black currants and gooseberry-bushes are obtained from close-budded cuttings, which are topped to make them throw out side branches. On farms the bush generally starts from the ground in many shoots, but red currants and gooseberries in gardens are grown in a single stem by cutting out the buds on the shoot up to the point of branching. The benefit of being on a single stem is, that the land is easier hoed and the fruit is higher above the ground, and therefore less earth is splashed on to it in heavy rain. The bushes starting their shoots direct from the ground are generally considered longer-lived, as young branches grow from them more freely.

These cuttings are planted firmly in rows about 16 inches apart, and 3 or 4 inches apart in the row. In the red currant and gooseberry plants shoots in right position to form branches are left; these are shortened to strengthen lateral shoots. At one year old the black currants are generally cut off at ground-line to strengthen the growth. After two years the bushes are ready to plant out.

Plum, apple, and pear seedlings may be budded or grafted, but it is generally better to buy these from a good nurseryman.

Renovation of Old Orchards.

First try the effects of a good dressing of manure round each tree. If the tree has luxuriant foliage and no fruit, cut off the extending roots by digging a trench round the tree at a safe distance to preserve stability; or the roots on one side may be cut one year, those on the other may be cut the following year, —the probable effect will be the production of fruit. If though the tree be healthy it bear worthless fruit, the branches may be headed off, and the stumps grafted with the best varieties: for old apple-trees the "Stone apple" makes a good graft; the best result is obtained by grafting the following year one of the shoots that springs from the stump itself. If the trees are infested with moss and lichen, their bark should be scraped and lime-washed. When large boughs have to be sawn off, they should be removed as close as possible to the trunk, while a notch should be made on the under side of the bough to prevent the tearing of the bark. A perpendicular surface throws off the rain best. The wound should be smoothed over with a sharp knife, to aid in the healing, and may be painted with a waterproof substance such as patent knotting. In the

Herefordshire orchards the interiors of the trees are cleared from the perpendicular shoots that spring from the branches by cutting them off clean with a mallet and broad chisel made with a short wooden handle, or with a handle 4 feet long.

If dead trees are to be replaced, change the kind of tree—*e.g.*, substitute plum, cherry, or walnut for apple or pear. Do not plant in the same hole, or if this is necessary, add fresh soil or mix lime with the old soil.

Cherry, apple, and pear timber is heavy, hard, and close-grained. The apple and pear should be well seasoned before being used. They are all suited to make cogs, mallets, tool-handles, and wood screws.

Cherry is also used for shoe-pegs and cabinet work.

For fuel, apple wood is good, while plum is inferior.

Fruit Picking, Packing, and Storage.

Fruit-picking should, if possible, be done when the fruit is dry; the fruit should be gone over frequently to get the bulk a little before its prime, as it then travels better. *Green gooseberries* go to market in bushel or half-bushel baskets, and the earliest in pecks. For long distances they are sent in sacks. Large green gooseberries usually give a better return in this state than when ripe. Picking at this time saves the energy of the plant (especially with young plants), and labour is not so much taken up at this season as when the gooseberries are ripe.

Cost of picking varies largely with the crops. The following gives some idea of the cost in West Kent:—

No. of gatherings.		Rough cost per ton.	Rough cost per acre.
12	Strawberry, per peck of 12 lb., 3d. to 5d.	£3 18 0	£8 0 0
5	Raspberry, per peck of 12 lb., 6d.	5 0 0	10 0 0
3	Gooseberry (green or ripe), per half-bushel of 28 lb., 5d.	1 14 0	5 0 0
2	Red currant (with strig), per half-bushel of 28 lb., 6d.	2 0 0	4 0 0
	Red currant (without strig), per half-bushel of 28 lb., 10d. to 1s.	4 0 0	8 0 0
1	Black currant (with strig), per half-bushel of 28 lb., 6d. to 1s.	4 0 0	8 0 0
	Black currant (without strig), per half-bushel of 28 lb., 1s. 3d.	5 0 0	10 0 0
1	Plum, per bushel of 56 lb., 6d.	1 0 0	7 0 0
	Cherry, per bushel of 56 lb., 1s.	2 6 8	9 0 0
1	Damson, per bushel of 56 lb., 1s.	2 0 0	12 0 0
1	Apple (large or small), per bushel of 40 lb., 1d. to 3d.	0 14 0	7 0 0
	Pear, per bushel of 40 to 56 lb., 4d.	0 11 8	7 0 0
	Nut, per peck of 7 lb., 3½d.	4 13 0	3 0 0

The earliest *strawberries* are picked and placed in punnets at about ½d. per pound, and packed in crates. When the fruit is commoner they are packed in peck baskets, usually left open at top.

Some of the finest *raspberries* are picked and punneted at about 1d. per lb. Most are packed in peck baskets or half-hundredweight tubs.

Red and black currants go to market in peck baskets covered over with paper. Black currants, if allowed to become full ripe, drop, especially in dry weather. Fallen apples and plums should be collected and removed in order to extirpate insects, which frequently cause their fall. Fallen and small apples produce excellent jelly. They are boiled whole, strained through canvas and flannel, and the juice re-boiled with sugar till a firm jelly is produced.

Broad-step ladders are good for gathering the fruit from, as they do not injure the branches, which cannot be avoided in leaning a rung-ladder against the trees.

In Canada it is common to use a ladder broad at the foot, with a long pole hinged on at top, by which stay the ladder is kept erect.

Handled baskets hooked on to the ladder are generally used to hold the fruit; in the case of apples, bruising is largely avoided by the gatherer using a sack with a slit on the upper side to admit the fruit. The sack is carried diagonally across his body tied over the shoulder.

Plums are sent to market in half-bushel baskets; *apples* in bushel baskets and hampers.

Apples shrivel if gathered immature, and should therefore be left on the tree till the stalk separates itself readily from the twig upon gently raising the apple.

Apple storage.—The apples are gathered when dry, sorted as to size and quality; the damaged ones are rejected, and sent at once to market. In Ontario, the sorting tables and ledges round them are covered with thick flannel in order to avoid bruising the fruit when emptying the baskets.

Apples may be placed at once in clean flour-barrels. The apples are stored in a building having pure air and a cool even temperature.

Apples are commonly laid out on the floor on straw in a shed or barn, with straw at the sides, the apples being two or three feet deep.

If a fruit store is specially built, the exterior may be of weather-boards, the interior of match-boards, with sawdust between; roof of heather or thatch. The house needs no other flooring than the soil; light should be able to be excluded; shelves 3 feet wide and 2½ feet apart, made of battens about 2½ inches wide, with half-inch spaces between. Ledges about 1 foot deep retain the apples; by this means air can circulate between the apples. Apples in single layers keep well on cork-dust or fine brick-earth. These should be examined about every ten days, especially during damp weather, as decay is then most likely to set in. All rotten and damaged apples should be removed as soon as noticed to prevent spread of decay.

Conveyance of Fruit to Market.

To avoid shaking, which damages the fruit, if the market is within driving distance the fruit is largely sent up to market by road on spring-vans, which carry about 40 bushels, going up by night to be in time for early market. The carriage costs about 1s. per mile outward journey; the vans are frequently loaded with manure to return with.

If contracts for direct supply are obtained from factories, shops, hotels, restaurants, and private consumers, these will probably be more remunerative, and the surplus may be sent to market.

Many salesmen provide their own baskets to be used for conveying the fruit, which is taken to their stalls and sold; an account of sales is sent daily, and a cheque for the amount received at the end of the week, 7½ to 10 per cent being deducted for commission, or 6d. per bushel, 4d. per half-bushel, 3d. per peck.

Literature on the Subject.

I have now passed from the planting of the fruit to its leaving the fruit-grower, and for study I would recommend the following books, from which I have received valuable information :—

The Essays on Fruit Cultivation, by Charles Whitehead, in the Royal Agricultural Society's Journals.

"Fruit Cultivation and Management in Kent," by G. Webb, in the 'Transactions of the Institution of Surveyors.' Read November 27, 1875.

The Apple and Pear Conference Papers, 1889, of the Royal Horticultural Society.

'Fruit Farming for Profit.' By G. Bunyard.

'Profitable Fruit-Growing.' By J. Wright. (Gold medal essay.)

'The Miniature Fruit-Garden.' By Thomas Rivers.

Fruit on Allotments and in Cottage Gardens.

The cost of fruit cultivation, unlike ordinary agriculture, is very little more, proportionately, on a small than on a large area, for there is so much hand labour. A good deal of the lighter work can be done by the wife and children of the labourer, and cottagers usually take special interest and care of fruit trees and bushes planted in their gardens, the fruit being of great value as an article of diet.

Fruit Cultivation suitable for certain vacant Land.

Some land that is too steep for ordinary farming operations, might, if good, be used for fruit cultivation: for example, strawberries would probably do well on many railway banks having a southern aspect; whilst fruit-trees may be trained against farm buildings, and I have seen a good red-currant fence.

Varieties of Fruit suitable for growing for the Market in Scotland.

I am indebted to Mr Palmer, of the Duke of Buccleuch's Gardens, Dalkeith, for his opinion as to the varieties suitable for market.

Strawberries.—Garibaldi, Keen's Seedling, James Veitch, and Laxton's Noble, a new variety, but seems specially good. Elton Pine is a late variety.

Raspberries.—Fill Basket, Northumberland, Falstaff, Red Antwerp, Carter's Prolific.

Black Currant.—Black Naples, Black Prince, and other varieties with large berry.

Red Currant.—Victoria or Raby Castle.

White Currant.—White Dutch. White currants are not so much grown as red, as they neither travel as well nor keep as long, and even more eaten by birds.

Gooseberries.—Whinham's Industry, White Smith, Hebron Prolific, Red Warrington, and Ironmonger for jam, Crown Bob, Lancashire Lad, Red Captain, Sulphur, and Hedgehog.

Plums.—Victoria, Czar, Coe's Golden Drop, Washington, and Pond's Seedling. In England the Early Rivers is one of the most profitable.

Cherries.—Morello and May Duke.

Pears.—Marie Louise, Louise Bonne, Beurre Diel.

Apples.—Lord Suffield, Warner's King.

For varieties of apple and pear I would recommend reading in the Journal of the Royal Horticultural Society the paper read by Mr Malcolm Dunn on Apples and Pears suitable for Scotland in 1889, and also the information received from different districts of Scotland as to the varieties that do best, when votes were taken on the subject.

CALF-REARING.

By the Rev. JOHN GILLESPIE, A.M., Mouswald Manse, Ruthwell.

THE question, What is the best and most economical system of rearing calves? has always been one of great importance, but never so much so as at the present time. For some time young store cattle have been dear in the market, to an extent quite out of proportion to the price realised for the same class of beasts after they have been made fit for the shambles. This has been mainly due to the scarcity of young lean cattle. Three years ago the returns got for the breeding and rearing of ordinary commercial cattle were so unremunerative and unsatisfactory that not a few either went entirely out of the business of rearing, or, at all events, considerably curtailed the extent to which they had hitherto carried on that branch of their operations. Hence the great scarcity of home-reared bovine stock that has been experienced of late.

This state of matters has been aggravated by the fact that nowadays more cattle are required by farmers than was the case when farm-stock was brought to maturity more slowly than is now the practice. Early maturity involves keeping the animals for a shorter period than formerly. Their rapid development and ripening are produced not by the individual beasts consuming a larger quantity of the bulky produce of the farm in a given time, but by their being allowed a more liberal supplement of rich concentrated food, either home-grown or purchased. Hence an increased number of live-stock are needed year by year to consume the grass and crops raised on the farm.

There are two different sources from which the increased requirements of the British farmer in lean cattle may be supplied. The one of these is, rearing a greater number of calves at home, and the other, the importation of beasts suitable for feeding from abroad. But for the danger of importing contagious and infectious diseases, the latter expedient might be largely taken advantage of. No evil results have followed the introduction into our home herds of Canadian store cattle, and no doubt the extent to which the Dominion can supply our feeders with lean beasts is capable of still further development. The United States of America—especially the Western States of the Union—have a very large supply of surplus lean cattle, the importation of which into this country might be a mutual advantage could they be allowed to go inland from the ports of debarkation without the danger being incurred of thereby carrying disease to the members of our own herds. No practicable scheme has as yet been devised by which this could be accomplished with safety, and until this is done our cattle-feeders must lay their plans to do without them. It would be a very foolish and expensive policy which, after having incurred an enormous expenditure in freeing Great Britain and Ireland of such a subtle and contagious disease as pleuro-pneumonia, would complacently open the door to the reintroduction of it and other infectious maladies by the importation of live-stock from those foreign countries which cannot show a clean bill of health.

But even on the assumption that our wants could with safety be supplied to a much greater extent than at present by bringing lean cattle from abroad, the British cattle-feeder must always be dependent for the vast majority of the frames he clothes with flesh and fat on animals bred and reared in our own country. Indeed, this is a mere truism. Seeing then that cattle-rearing must always continue to be a prominent and important part of the work of a large number of British farmers, the question of the best and most economical system of rearing calves is one of the utmost practical importance to that class of farmers.

There are several advantages attending the home-rearing of calves which those interested would do well to realise clearly. For one thing, a great loss must have been sustained by the nation and by individuals from the extensive slaughter of newly dropped calves that has been going on in this country for a considerable length of time. The live-stock statistics are not taken in a form to enable a reliable estimate to be formed of the number of very young calves that are sacrificed shortly after their birth. But every one with good opportunities of observation is aware that in many localities, and in dairy districts especially, the number of calves slaughtered when worth only a few shillings per head has been very large. Could the greater number of these be saved from a premature death, and reared at as moderate a cost as is practicable, the property of farmers would be enhanced to a corresponding degree, and we would be the less dependent on the foreigner for our supplies of beef.

Home calf-rearing also tends to give cattle-owners an impetus in improving the quality of their herds. The profit derived from the possession and use of superior sires and dams is the better realised. There is nothing more unsatisfactory or unprofitable than grazing and feeding inferior ill-bred cattle. They consume the same food as good ones, with, however, very much worse results. One indirect advantage of rearing one's own beasts is, that thereby their superior quality can be more certainly ensured. It is a tantalising experience—not infrequently encountered—to pay a high in-laid price for stores which turn out indifferently, and some of them even badly. This state of matters is greatly aggravated by the extent to which a large number of commercial cattle are injured from being taken from market to market before coming into the hands of those who are destined to feed them until they are fit for being slaughtered. The expense incurred in keep, railway charges, and other outlay, must often in such cases be considerable. The purchaser has in the long-run to bear these expenses. But that is only a portion of the evil bequeathed to him, for he gets possession of animals that have got a back-set from the treatment they have received, the consequence being that they consume his food for a considerable time before they recover, begin to thrive, and make perceptible progress.

Another important advantage of home calf-rearing to the British farmer is, that he thereby eliminates as much as possible from his business the element of speculation, and turns his farm into a manufactory on which almost all the raw material used is raised. The business of cattle-feeding—where the store cattle are purchased, not reared—has for a series of years been a very speculative one, and of late it has been very unprofitable. The purchaser has been dependent on the market price of lean beasts, which has often been so high as to leave him an insufficient margin to recoup him for his outlay and trouble in preparing these animals for the fat market. During recent years of severe agricultural depression, those occupants of mixed farms have fared best who have combined rearing with feeding. They may not have made their holdings profitable to a satisfactory extent, but at all events they have suffered less from the effects of the depression than those who have trusted to the open market for a supply of feeding cattle. They have steadily pocketed whatever profit was to be had, including that of the middleman.

Whatever system is adopted, calf-rearing, to be successful, demands not only skill, but, above all, careful management and unremitting personal superintendence. Where pail-feeding is followed, the person in charge must be thoroughly reliable, and very painstaking. The food must be given with scrupulous care and regularity. This is most important when nothing except the natural food of new milk is given. But where, from the milk being supplemented by other articles, a mixed diet is given, care and attention at every stage are of exceptional moment. If the ingredients are not used in the proper proportions; if the constituents are not evenly mixed; if the right quantity is not given to each calf or at the proper temperature, —when some of these all-important conditions are not complied with, and especially when all of them are neglected, the results cannot but be unsatisfactory. There is an old and a true saying to the effect that nothing conduces so much to the thriving of a horse as the watchful eye of the master, and in no department of farming does this principle hold good in a greater degree than in calf-rearing. Constant supervision on the part of the farmer or some member of his family is simply invaluable. Old and reliable servants are occasionally found who could not be surpassed in this sphere of labour. Where such hired helps are not available, and members of the family are in the habit of taking their share in the work of the farm, by all means let them not consider it beneath their dignity to at least superintend the upbringing of the youthful bovine stock of the farm.

Calf-rearing can never be said to be successfully prosecuted if the calves are not kept in a healthy, growing, progressive state. To rear calves and starve them is the worst possible policy. In former times when cattle were very slowly brought to maturity, it was considered good management to keep them on very short commons in the earlier months of their existence. And possibly, in view of the poor keep allowed them afterwards, liberal treatment at first would have been thrown away to some extent. But nowadays stock-owners are becoming more alive to the importance and profit of keeping animals, that are intended for beef, well at every stage of their existence. Early maturity is what is now aimed at by all enlightened and enterprising farmers, and it goes without saying that this can only be secured where the beast is kept on a liberal diet from the very first. Indeed it is the truest economy to feed the young calf well. It will make more rapid progress on less food at that stage, when its powers of consumption are necessarily small, than a year or two later when its capacity of consuming food has been greatly increased.

However, as regards food and general management, much discrimination and economy can be practised in calf-rearing. The main object to be aimed at is to rear a maximum number of calves at a minimum of expense. There is no doubt that some people succeed in rearing good ones at less outlay than others. Excellent articles of many kinds may be produced at too great a cost, and this applies to young cattle as much as to other things. They may be reared even at an extravagant expense. In the case of what may be termed commercial cattle kept solely for the purpose of profit, the cheapest plan should be adopted that will produce an equally good result.

The most ancient, and, some say, the most successful method, is to allow the calf to run with its dam and be suckled by it. In ordinary circumstances year by year with cows, this plan cannot be commended as a remunerative one. Where the cow supports only her own offspring, the calf is had at weaning-time at the cost of a year's keep of a cow, which is certainly a high price to pay for a six or seven months' old beef animal. The only recommendation in its favour is, that it reduces the labour bill to a minimum; but even with every weight that can be attached to that consideration, this must be pronounced an extravagant system of calf-rearing. The case is somewhat changed where a couple of calves are reared by one cow. Where the dams are of fairly good milking strains this is quite practicable, and, indeed, in not a few cases it is followed with results that cannot be considered altogether unsatisfactory. Where economy in manual labour is a matter of moment, this plan has obvious advantages. We believe that one calf, or at most two calves, might be taken with profit and advantage from heifers on classes of land that are specially adapted for the rearing of young cattle. Two-year-olds, and occasionally extra-strong yearlings, might be served in time for the calves to drop as the grass is coming in late spring or early summer. Their own calves might be left to run at their feet until they are, say, three months old, when these might be weaned, and each young cow got to take another in the place of her own. Supplemental food might be given to her from this point, with the twofold object of increasing the flow of milk for the support of the young calf, and of improving her own condition preparatory to her being made fit for the shambles, which she should be during the ensuing winter. She would be marketed for beef at a comparatively early age, and she would have brought up two calves, of one of which she was the dam. If made really fat before being disposed of, she would realise the full value of the best heifer beef, for she would show little or no trace of an udder. We have known of not a few instances in which this system has been followed with satisfactory and profitable results, especially where the circumstances were such as to render it desirable to provide a supply of home-reared cattle, and yet incur a small labour bill. In other cases, a second crop of calves is in the habit of being taken before the dams are made ready for the fat market. But the drawback of this second season's calf-rearing is the danger that the mothers will have an unmistakable cow-like look even after being dried, and consequently sell at the reduced price of cow-beef when they come to be marketed.

However, while the more natural plan of allowing calves to suck their dams can be followed with satisfactory results in individual instances, yet rearing calves by the pail will continue to be the method almost universally adopted by the rank and file of farmers in this country. Now the question to be solved is, What is the best and most economical plan to pursue in this way? A very large proportion of cattle-rearers use little else than new milk in feeding their calves during the earlier months of their lives. But this is an expensive system. Of course, if the element of cost is kept out of view, it will be universally admitted that no diet is so good as the natural one of new milk fresh from the cow. Milk is a perfect food—that is, it contains in perfect proportions all the different ingredients necessary for maintaining the vital functions and building up the body of the young animal. Further, it contains these constituents in a form most easily digested and assimilated by the tender youngster. The question whether and how far other kinds of food can be profitably employed as supplements to or as substitutes of whole milk, depends in some degree on the value of the latter to the farmer. We believe that the cases are altogether exceptional where new milk is of so little value that other articles cannot be economically substituted in place of at least a portion of the more natural food. In some instances all the milk may be utilised by supplementing it with other things so as to rear a considerably greater number of calves than would otherwise be possible. In dairies, again, where milk is sold or manufactured into cheese or butter, a full quota of young cattle may be raised, and yet the milk utilised for this purpose may be curtailed to a comparatively limited extent. To its other advantages this mixed system adds this one, that the farmer has thereby not only two strings to his bow, two separate baskets into which he puts his eggs, but he may make profit out of each department, and thus increase the balance of profit in his favour. In proportion as farming gets more scientific and skilful, such expedients are likely to be the more generally resorted to. At one time it was considered almost impossible to curtail the quantity of new milk allowed and yet raise good calves. I have a vivid recollection of the astonishment I felt on being told, when very young, that a particular farmer's wife, whose calves were thinner and more lanky than I was accustomed to see, had struck her calves on the head with the churn-staff. This of course meant, as was explained to me, that in her desire to have a large churning of butter, she had taken too much cream from the milk on which they were fed. Nowadays it is quite common for calf-rearers to have abundance of butter without the calves being unduly stinted in their food. Our object in what remains of this paper is to give an account of some methods of calf-feeding by which this is successfully and economically accomplished. For particulars as to a number of these plans we are indebted to a number of kind correspondents, to whom we hereby beg to tender our grateful acknowledgments, while the details of two other methods have been derived from papers on the subject in other publications.

The mode of rearing pursued by Mr John Treadwell, Upper Winchendon, Aylesbury, Bucks, being somewhat peculiar, and at the same time very successful, must be pretty fully sketched. He sells his milk to the Anglo-Swiss Condensed Milk Company, which has a factory at Aylesbury, seven miles from the farm. The class of cows kept are what Americans would term "grade" shorthorns. The farm is a mixed one of about 380 acres of arable and 760 acres of grass land. In addition to keeping a dairy of cows for milk, Mr Treadwell rears all his home-bred calves, the heifers being retained as cows and the steers fattened for the butcher. He also breeds Shire horses, and keeps a flock of Oxford Down sheep, which we need scarcely add has a world-wide reputation. At present Mr Treadwell is milking 130 cows. These begin to calve in September, the calving season being almost entirely over by the end of January. The cows are liberally fed at all seasons. The Sunday morning's milk, not being sold, is skimmed and the cream churned into butter,—this single meal of skimmed milk being largely utilised for the rearing of the calves. Being boiled on the Monday, it keeps during the winter months quite sweet during the remainder of the week. The newly dropped calves suck their dams for about a week. The following week they are fed upon boiled new milk, about five pints being the allowance given morning and evening. Then for a fortnight the principal diet is skimmed milk, after which a little of Simpson's Calf Meal is substituted in lieu of some of the milk, the one being increased and the other diminished as time goes on. When the supply of skimmed milk—obtained as above explained—runs short towards the end of any week, a mixture of new milk and water is substituted in its place. Some oats and mash are given, then oilcake and mixed meal, the quantity being gradually increased until an allowance of about 2½ lb. each per day is reached. The calves are got to eat swedes, and so by the time they are ten or twelve weeks old they are weaned from milk and the above calf-meal. They have also hay put before them *ad libitum*. This diet is continued until the grass comes, when they are turned out to some poor grazing land, and get a mixture of about 2½ lb. of decorticated and linseed cake during the summer, which makes them come into winter-quarters in fresh condition. This winter Mr Treadwell has reared upwards of eighty calves in the manner we have described. He concludes his valuable communication to me in the following significant terms: "Cattle, sheep, and horses all graze together, my aim being to breed as many head of each class as I can, and to make fat and sell out as many as

I can without buying. I wish to do away with the middleman, or rather, keep his profits to myself—making one thing fit in with another all round, as in these times I cannot afford to leave my corner to be filled by some one else."

In a valuable communication received from a high authority in Derbyshire — viz., Mr Gilbert Murray, Elvaston Castle Estates Office—we quote the following admirable remarks on the great importance of giving whatever food is supplied to young calves at as even a temperature as possible: "A fruitful source of failure, and the chief cause of derangement in the system of the young animal, is the varying temperature at which the milk is fed. This is a point which admits of no variation. Eighty degrees Fahrenheit, or about 10° below blood-heat, is the proper temperature to have it. If the temperature has to be raised by artificial means, it should not be done over a fire. The milk should be placed in a tin vessel, and the temperature raised to the standard by placing the vessel in a copper or furnace of boiling water. Where steam is available it may be utilised for raising the temperature without coming into direct contact with the milk."

Mr Murray approves highly of separated milk being used in calf-rearing: "The milk being perfectly sweet, it is in an excellent state for being given to calves, and though robbed of the butter, it contains all the other constituents of the milk. An equivalent for the fat can be substituted at a much cheaper rate. Hence the great benefit to be derived by the establishment of Creameries or butter factories, every one of which should be a centre of a wide calf-rearing district. When separated by mechanical means, the milk, or at all events a portion of it, should be returned to the farm and utilised for the purpose of calf-rearing."

Mr Murray gives the following recipe for supplying the abstracted fat as one which he has found to answer admirably: To two parts of oatmeal add one of wheat-meal, one of ground peas, and one-fourth linseed. The mixture should be steamed and mixed with the milk. He advocates small quantities of food being given to young calves at short intervals, say three times a-day for the first month. As soon as the youngsters begin to eat, he prefers a mixture of wheat-meal and ground linseed, with a small quantity of bran or nice sweet hay chaff.

Mr A. Ralston, Glamis House, reports the system pursued by the most successful calf-rearers in Forfarshire to be as follows: The calves for the first week or so receive three feeds of milk per day, the morning feed being of new milk, and the other two of skim-milk, the quantity given being about 6 gills per feed. As the calf grows older the quantity is gradually increased. When about three weeks old, or slightly before that age, the sweet-milk is given up and the skim-milk increased to about 9 gills per feed. A substitute for the fat in the new milk is provided in the form of a mixture of ground linseed-meal, oatmeal, and locust-bean meal in equal proportions; the total weight of the mixture to begin with not exceeding 1 lb. per calf per day. This is increased as the calf grows older to about 1½ lb. The mixture is either boiled or scalded with boiling water until it assumes the consistency of thick gruel. It is then poured among the skim-milk and given to the calves at every feed. When about six weeks old the calves receive along with the milk and gruel (now increased to about 12 gills per feed) from ½ lb. to ¾ lb. of linseed-cake per day, along with a few handfuls of sliced turnips, and this treatment is continued with a gradual increase in both liquid and solid food until the age of three and a half to four months is reached—when the liquid, which by this time had been increased to about 16 gills per feed, is entirely stopped, and the calf, like the older cattle, has to depend entirely on solids.

Mr Ralston reports the successful practice of an enterprising dairy farmer who, while following in its general features the plan above sketched, separates the cream from his milk by mechanical means, and gives the skim-milk thus obtained to the calves in the warm state as it comes from the cow. He attributes much of his success as a calf-rearer to this feature of his practice, which corroborates the testimony of Mr Gilbert Murray in two particulars—viz., the value of fresh sweet separated milk, and the great importance of giving it at a proper temperature.

Mr James Duncan, Panlathy Mill, Carnoustie, has successfully reared calves on milk supplemented by "Lactina." He allows the cow and calf to remain together until it has had one feed from her. For ten or fourteen days it is fed on new milk, thereafter a breakfast-cupful of Lactina (diluted according to directions) is mixed with the milk, the latter being reduced in quantity in proportion to the Lactina given. The natural food is gradually withdrawn, and the artificial steadily increased, until in five or six weeks the food is composed entirely of the latter material. If in the winter season, some pulped or sliced turnips are allowed; and if in the summer, the calves have the run of the grass as soon as they can eat it.

Mr Garrett Taylor of Norwich gives the following account of the system of rearing pure red polled calves pursued on Whitlingham farm, where the milk is produced for sale. As soon as born, the calves are put into separate cribs, and during the first week they have a daily allowance of about six pints of skimmed milk, and after that time a small quantity of calf-meal, mixed in skimmed milk if there is any to spare, and if not in lukewarm water. When the calves begin to eat, equal parts of linseed-cake (ground), malt, Barber's feeding-meal or any condiment meal, mixed with a little cut hay, are given to them daily, and they are kept on this until they are strong enough to take care of themselves, when they are drafted (five or six together) into a large box, and fed upon roots or grass, according to the time of the year, along with a small quantity of condiment feeding-meal, until they are about four months old, when they are again drafted into larger boxes (this time ten or twelve together), and the diet again altered to a small quantity of sweet ensilage, some roots or grass, according to the season, and 2 lb. per head per day of condiment feeding-meal. They are kept on this diet till they are twelve months old, and then turned out to grass, it being very seldom that any cattle on the farm are turned out to the pastures before they have reached that age.

Mr R. Rowell, Middle Branton, Newcastle, after trying many methods, has fallen back upon one which he has found to answer best, and by which, with the milk of four cows, he can rear successfully no fewer than thirty calves. One distinctive feature of his system is to feed from an early stage with dry instead of with liquid food. By this method he very rarely has a case of "skit," and he has scarcely ever incurred any loss. The calves are at once removed from the cow on being dropped, and for the first fortnight they get, three times a-day, two quarts of new milk with a little water added. Thereafter they are gradually changed to a diet of skimmed milk and ground linseed-meal. One half-pint of the meal is scalded, and added to a quart of skimmed milk. This mixture is given to each calf until it is two months old, when liquid food is entirely discontinued, as they have learned to feed by this time, and do well on other food. In addition to nice sweet hay and turnips, cut with a sheep-cutter, they have as much as they will eat of the following mixture—viz., 2 parts each of bran and bruised oats, and 1 part of linseed-meal. Sometimes a little pure linseed-cake is given by way of variety. A constant supply of pure water is kept in their boxes. Mr Rowell houses his calves in loose boxes, wherein there is room for from six to ten calves, with ample space for exercise. He finds the newly dropped ones do best along with those that are older, because the latter teach the younger ones to eat at an early stage. It is preferred to have the calves dropped before April if practicable, and they are turned out to grass by the middle of June, but the youngest ones are always taken under cover during the night.

Mr W. H. Ralston, Culmore, Stranraer, has successfully adopted the following method of rearing cross-bred calves out of his Ayrshire cows, which are kept either for the sale of milk or cheese-making, according to the state of the market. For the first fortnight as much new milk as the calf can safely take is given. Then skimmed milk is substituted for a portion of the new milk, with a little boiled oatmeal added. Thereafter only skimmed milk is allowed, with a mixture of two parts oatmeal and one part linseed-meal, steamed together. By this time the calf will eat a little hay, and so soon as it can be got to take it, a small quantity of finely ground linseed-cake is given. This diet is continued until it is considered safe to substitute, in place of a portion of the skimmed milk, fresh-drawn whey. The one gradually takes the place of the other, until whey is the only liquid food given. One season, when the new milk was sold to the Dunragit Creamery, and when consequently no whey was available, butter-milk was bought from the Creamery at 2d. per gallon, and Mr Ralston thought it made better calves than anything else he ever tried. Indeed, although unfortunately we have no definite detailed experience of individual calf-rearers who use butter-milk to submit to our readers, yet it may safely enough be asserted that on this material calves thrive admirably, and grow into well-developed excellent cattle.

Mr Andrew Allan, Munnoch, Dalry, Ayrshire, adopts the following plan in rearing Ayrshire calves of both sexes where cows are kept mainly for cheese-making. New milk is given for the first four weeks. Thereafter a supplement of oatmeal and oilcake (scalded) is mixed with the milk, and this is continued for about three weeks. Whey is then gradually substituted for the milk until the latter is entirely discontinued. At three months old they get nutted cake dry, in supplement of the natural keep on the farm.

On Downan farm, South Ayrshire, Messrs Wright keep a dairy of 70 cows, which are let to a bower for cheese-making—with a few additional cows kept to supply milk for the farm and the ploughmen, &c. Calves are also reared. The calves kept are generally dropped in the latter half of February and in March, but occasionally calves coming in April are reared if they are out of exceptionally good cows. For the first day they are fed on their mother's milk alone, and thereafter with mixed milk. For the first three or four days the quantity allowed is 3 lb. new milk per calf daily—it being measured, not weighed, but weights are quoted throughout for greater accuracy. It may be mentioned, in passing, that 1 gallon of milk weighs a little over 10 lb. About the fourth day the daily allowance is increased to 4 lb., which is continued till the end of the first week. During the second week the quantity given is raised to 6 lb., which is increased to 8 lb. during the third week. This is the maximum allowance of whole milk, and it is usually continued until the calves are about three months old. When three weeks old the calves have a supplement of meal, of which various mixtures have been tried, but the two following have given the best results:—

(*a*) 2 parts pure linseed-meal (not cake-meal).
1 part pea-meal.
1 " oatmeal.
(*b*) 1 " linseed-meal (as above).
1 " pea-meal.

The latter mixture has the advantage of being the cheaper of the two, but the former is probably more nourishing. The mixture is added to the milk night and morning in a raw state, the quantity being gradually increased until the allowance per head reaches 1 lb. daily. When the allowance of meal has become considerable, Messrs Wright prefer to boil it into a kind of porridge before mixing it with the milk. When the calf has reached a couple of months of age, the quantity is gradually augmented to 2 lb. daily, which is the maximum quantity of supplemental concentrated food allowed. They are encouraged to eat hay from the time they are four weeks old, it being offered to them *ad libitum* as soon as they partake of it freely. They are turned out during the day about the middle of May to an old grass-field of rather poor quality and with a northern exposure. The mixed diet of new milk and meal is continued till the first of June, when the new milk is withdrawn and an equal quantity of skim-milk substituted for it—the meal, however, being continued. By September 1 the milk is discontinued. On this method of rearing the youngsters thrive well, develop as well as Ayrshire stock are desired to do, and there is very little sickness or mortality among them.

A gentleman who rears calves extensively in Ireland—viz., Mr George Henry of Ennismore, Listowel, County Kerry—has given us an account of his system, according to which, it may be added, he reared no fewer than 200 calves last year, all of his own breeding. For four days the calf gets its mother's milk, for the reason that it acts medicinally upon the young animals. For the first fortnight it is fed three times daily on milk from which a little cream has been taken. In abstracting the cream Mr Henry does not use the separator, but the Jersey creamer, which, after a thorough trial, he strongly recommends for this purpose. From the time they are three weeks old, the calves get a supplement of boiled linseed mixed with the meal and other food—such as ground wheat and barley-meal which has been grown on the farm. By-and-by nice sweet hay is put in their racks, and they are also supplied with grated turnips with bean-meal shaken over them. The beans are ground, and only the fine meal given to the calves, the coarser portions being mixed with crushed oats for the horses. Mr Henry remarks that, where large herds of one or two hundred cows are kept, the separators are in his opinion absolutely necessary; but in the case of small farmers having from ten to thirty cows, he advocates the use of the Jersey creamer in well-constructed, properly ventilated dairies. The cream should be sent to butter factories three times a-week, and thereby a large saving is effected as compared with sending the whole milk twice a-day. Further, under this system the skim-milk would be retained at home for the feeding of calves and pigs. When potatoes were plentiful and cheap, Mr Henry has added boiled potatoes (without the skins) to the food of the calves after they were from two to three months old, with most successful results.

Mr Luke Christy, Carigreen, Limerick, allows calves to remain with their dams for the first three or four days; then the diet consists of new milk for the next ten days or fortnight, thereafter skim-milk being gradually substituted. The supplement used is porridge made of wheat-flour and flax-seed, enough of the mixture being added to afford a full drink to each calf.

In Part I., vol. xiv., of Second Series of the 'Journal of the Royal Agricultural Society of England,' Mr Henry Evershed gives the following recipe of a dietary followed in the counties of Surrey and Sussex: Six quarts of new milk daily for fourteen days from birth, and for the next six weeks 2 gallons of skimmed milk warmed and mixed with ½ lb. of linseed-cake, ¼ lb. boiled linseed, and ½ lb. split beans. The above seems a superfluous quantity of milk to give daily to a single calf.

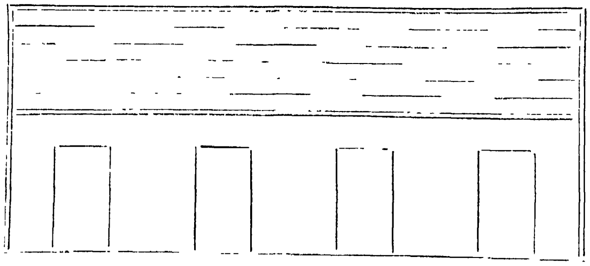
Mr Henry Ruck of Eisey, Wiltshire, adopts a plan by which he uses little or no milk after the first fortnight. He thus describes it: "Seven lb. of finely ground linseed-cake is dissolved in 2 gallons of hot water, and to this is added 2 gallons of hay tea; 7 lb. of mixed meal, consisting of equal parts of wheat, barley, oat, and bean meal, is also added, with 2 gallons of water. This mixture—which may be described as 7 lb. of linseed-cake ground fine, 7 lb. of mixed meal, 2 gallons of hay tea, 4 gallons of hot water—is given to the calves as follows: 2 quarts in the morning, further diluted with 2 quarts of water, and 2 quarts mixed with 2 quarts of water at night. Upon this gruel the calves thrive well, and they are weaned from it at twelve weeks old—having cost not more than from 1s. 3d. to 1s. 6d. per head per week."

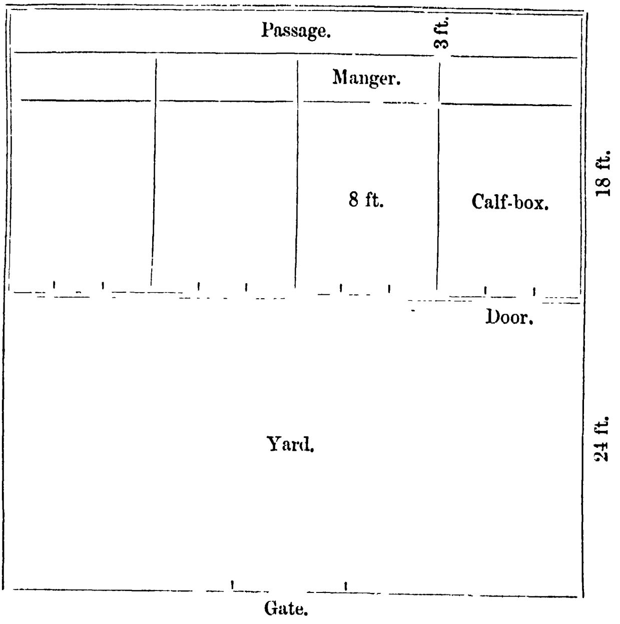
Before concluding, we would venture to impress upon calf-rearers the great importance of keeping their young calves in well-constructed, well-situated houses, and of seeing that they are kept in a cleanly, sweet condition. An idea used to be prevalent, but is now happily rejected by most farmers, that any sort of odd house, however situated, was good enough to keep calves in. It was not uncommon to find their quarters in the coldest and darkest side of the farm buildings, away from the warmth and brightness of the sun. Medical men are in the habit of impressing upon parents the great importance of having the nursery in a part of the house where the exposure is good, and where the room has the benefit of the bright genial sunshine. Such an influence is beneficial to the healthy development of the physical nature of the child. We submit that the very same laws apply to the healthy rearing of one of the lower animals, such as a calf, as hold good in the bodily development of a child. The calf-house should be in a warm situation, and while free from draughts, it should at the same time be sufficiently ventilated so as to preserve the atmosphere fresh and sweet.

We will conclude by quoting some excellent observations with which Mr Gilbert Murray has supplied us on this subject. He says:—

"The housing of the calves is of equal importance with that of the food. On some farms they are relegated to the worst building on the farm, dark, undrained, and ill-ventilated. The litter is literally soaked with urine, and the fermented droppings emit a noisome smell. Diarrhœa of a virulent type sets in, invariably proving fatal to the more delicate subjects. Peat-moss litter when used is an immense improvement on straw, as the moss absorbs the urine, retards decomposition, and keeps the calf-house in a sweet and healthy state. The droppings should be daily removed, and a slight sprinkling of moss added.

"The calf-house should be specially constructed for the purpose. No expensive structure is needed, the chief merit being in the design. We are frequently putting up wooden structures at a small cost which fully meet the requirements. The walls are of wood. Oak or pitch-pine posts, 8 inches square, are placed at intervals of about 9 feet apart. These are covered with 1-inch match-boards. The building is 6 feet 6 inches high to the under side of the wall plate, and 18 feet wide. The rafters are covered with half-inch match-boards, on which is laid a covering of roofing-felt, at a cost of 1d. per square yard. The roof must have a coating of coal-tar and pitch yearly. We have roofs of this description in perfect order after a period of twenty years' wear. The buildings are well lighted and ventilated, and are divided into pens of 8 feet by 15 feet. A 3-feet passage runs the whole length of the shed, parallel to which is the manger for holding the food. This can be cleaned out, and the animals fed, from the passage. Each pen has a separate door, in order that the calves may be shut up at night or during the day in cold weather. A large open yard is provided in front of the shed, into which the animals are allowed access for exercise in the open air. This tends to increase their growth,





while it maintains their health. Accommodation of this kind, though it may be rude and inexpensive, affords all the advantages of a more costly structure. Where the accommodation is suitable, the calves should not be turned out until they are a year old. Husk and many other disorders are brought on through exposure during the autumn of the first year of their lives. The best time for rearing calves under the old system is between the 1st of November and the end of January. Under the system we advocate, calves may be successfully reared throughout the whole year. Under it also the mortality would be considerably lessened, and the stock of the country soon be raised to its normal state."

The preceding is a sketch-plan of the calf-house which Mr Murray describes.

REPORT OF EXPERIMENTS WITH TURNIP MANURE IN KINCARDINESHIRE.

By JOHN HART, Cowie, Stonehaven.

IN presenting the report on the manurial experiments conducted in Kincardineshire, under the auspices of the Highland and Agricultural Society of Scotland, I have to acknowledge on behalf of the experimenters the liberal encouragement extended to them by the Highland and Agricultural Society of Scotland, and to thank the Directors for their liberality.

As convener of the committees, I desire to tender my best thanks for the great assistance in superintending and reporting on the experiments which I have received from the various district conveners—namely, Messrs Adam, The Bush; Findlay, Bishopston; and Fotheringham, Leithfield; and also to all the gentlemen who carried out these experiments, which, I venture to affirm, were done in the most careful and painstaking manner. It will be a sufficient guarantee of the trustworthiness of the results arrived at when it is mentioned that these experiments have been carried out by the following gentlemen—viz., Messrs Adam, Bush; Alcock, Easterside; Barron, Mains of Mondynes; Begg, Swinewaird; Brown, Mains of Dunnottar; Carr, Mains of Barras; Don, Auquhirie; Donald, Wester Logie; Dunbar, Westport; Dunbar, Newton; Duncan, Slains; Falconer, Druidsdale; Falconer, West Newtonleys; Farquharson, Mains of Catterline; Findlay, Balquharn; Findlay, Bishopston;

Findlay, Craighead; Fotheringham, Leithfield; Gillanders, Cairnwell; Guthrie, Townhead; Hendry, Catterloch; Hunter, Upper Mills; Hunter, Kirkton; Major Innes of Cowie; Messrs Murray, Kernoon; Nicol, Easter Muchalls; Paterson, Logie; Pratt, The Green; Rae, Haddo; Ritchie, Mains of Findon; Robertson, Hallhill; Spence, Crossgates; Stenhouse, Newtonleys; Stephen, East Mathers; Stewart, Badentoy; Stott, Causeyport; Stott, Powburn; Taylor, Uras; Wallace, Pitdrichie; Webster, Nether Criggie; Wood, Law of Lumgair.

From a glance at the above names, it will be seen that these experiments have been made under very considerable diversity of soil and situation, and, while the results brought out are primarily and principally of value to the individual experimenter, they may also be of service to those farming under similar conditions of soil and climate, and eventually they may establish some general principles of agricultural treatment. In the meantime the committee desire it to be clearly understood that they are, if possible, more strongly convinced than ever of the necessity of every farmer undertaking similar experiments.

There is no doubt that at every stage of progress in agriculture there are those who think that the end has been reached, and that no further improvement is possible. There are also those who, when the results of the experiments do not agree with their preconceived opinions, or when they seem conflicting, lose all interest in them, and do not hesitate to tell you that such experiments are of no practical value.

They remind me of what a worthy old farmer, who was a strong believer in lime and half-inch bones, said to his proprietor, when he was offered a few tons of fine-ground bonemeal in the way of a rent abatement,—"Na, na," he said, "what better would I be of that? my farm is no' used to that sort o' stuff." Such farmers forget that as there is a reason for everything, in such experiments as these, when carefully carried out, it will, generally speaking, be possible to explain such results or contradictions.

If it be granted that it is the farmer's interest to raise the largest crops at the least possible expense and without injury to the soil, it will surely be conceded that the best way to attain these objects is for every farmer to make such experiments. But on no account should they be undertaken by those who are not prepared to carry them out in the most *careful* and *thorough* manner. The committee recommend the prosecution of these experiments, not only for the valuable information which is to be obtained thereby, as to the most economical manures for the various crops, but also for their educational value, both directly and indirectly.

The results brought out on the different farms furnish subjects of profitable and pleasant discussion among experimentalists at their various rural gatherings. For in no business can it be said with more truth than in that of the farmer's, that we *cannot* "rest and be thankful." The intelligent and active farmer has an ample field before him. A great deal of land is very imperfectly cultivated; the yield might be greatly increased by a more perfect husbandry, and this can only be brought about by the application of skill resting on careful experiment and observation.

One result of these experiments has been to satisfy not a few of our most intelligent and successful farmers, that by a judicious adjustment and application of the manures hitherto used (including Thomas-slag), it will be possible to effect a considerable saving in their manure bill.

We often hear it said that farmers are the worst business men in existence, that they cling to antiquated methods and resist all improvements—thinking that what did in the easy-going days of our forefathers should do for all time. Whatever amount of truth there may be in that accusation, I am happy to think that it does not apply to the farmers of Kincardineshire. In no county in Scotland, I believe, have we a more enterprising class of men, as will be seen from the number and character of the experiments on which I am enabled to report. Though the primary object of these experiments is to determine which is the most suitable and economical turnip manure, it would be well that all the experimenters should carefully mark the plots, so that the results on the after crops of the rotation may be carefully noted and compared with the results of the turnip crop. I am sure the experimenters will, where possible, see that this is done.

When we consider the great diversity of soil, climate, and management under which these experiments have been conducted, it would be unreasonable to expect perfect harmony in the results. The apparent discrepancies, I venture to think, are all capable of reconciliation; but at present I have neither the time nor space to attempt the task. But we have not yet arrived at that stage when we can guarantee that a particular manure will invariably produce certain effects; but we are striving after more accurate knowledge, and I strongly commend these and suchlike experiments to those farmers who think that they have not yet reached that position in agriculture beyond which progress is impossible.

There is one point brought out very clearly by these experiments to which I should like to refer—viz., that the application of manures, especially the more soluble, to light dry soils, resting on porous subsoils, has had generally the effect of reducing the weight of the crop. This is also very noticeable when comparing the autumn *versus* spring manured plots. I think this may be accounted for by the fact that the past season was very favourable for the starting of the turnip plants, and that those so treated were in a more advanced stage than those which had received no artificial manures, or had it of a more insoluble sort; consequently they were more liable to be damaged by the dry parching weather which we experienced in the months of June and September, when they received a severe check. In such experiments as these, the weather must have a great influence on the results, and it will be instructive, when comparing the various experiments, to have a note of the rainfall before us, which was kept at Raemoir House, and which will be applicable to the following farms: Bush, Upper Mills, Green, Newton, Kirkton, Mains of Raemoir, and Catterloch. A note of the rainfall was also kept at Lumgair, and it may be considered to hold good for the following farms—viz., Bishopston, Badentoy, Balquharn, Easter Muchalls, Westport, Logie, Wester Logie, Auquhirie, Uras, Swinewaird, Causeyport, Mains of Findon, Craighead, Mains of Dunnottar, Nether Criggie, Crossgates, East Mains of Barras, West Newtonleys, Cairnwell, Easterside, Druidsdale, Lumgair, Kernoon, Newtonleys, Law of Lumgair, and Lumgair.

The following is a note of the rainfall at Raemoir House, stated in inches and decimals of inches:—

1889.

March.		April.		May.		June.		July.		Aug.		Sept.		Oct.		Nov.	
Date.	Inches. Decimals do.	Date.	Inches. Decimals do.	Date.	Inches. Decimals do.	Date.	Inches. Decimals do.	Date.	Inches. Decimals do.	Date.	Inches. Decimals do.	Date.	Inches. Decimals do.	Date.	Inches. Decimals do.	Date.	Inches. Decimals do.
1	.10	1	.15	1	.35	2	.42	7	.17	2	.13	18	.34	3	.15	1	.43
2	.05	3	.20	2	.10	7	.28	8	.13	3	.07	20	.03	5	.12	3	.04
3	.12	4	.25	4	.10	9	.21	9	.18	6	.49	21	.10	6	.17	9	.28
5	.10	5	.40	25	.05			11	.55	7	.32	25	.12	8	.10	23	.07
6	.05	6	.50	29	.23			12	.07	9	.07	26	.11	10	.13		
12	.03	7	.45	30	.02			13	.19	10	.47	27	.16	11	.06		
17	.25	8	.50	31	.02			14	.20	11	2.20	28	.05	13	.08		
18	.30	9	.40					15	.56	12	.08	30	.10	15	.10		
19	.50	10	.15					16	.33	13	.07			17	.15		
20	.10	11	.45					21	85	14	.05			18	.26		
21	.20	12	.50					23	1.07	15	.45			19	.06		
31	.10	13	.20					28	.07	21	1.27			20	.25		
		14	.10							22	.32			21	.20		
		25	.50							25	.10			22	.10		
										26	.03			23	.09		
										27	.45			24	.25		
										29	.07			27	.20		
														30	.10		
	1.90		4.75		.87		.91		4.37		6.64		1.01		2.57		.82

The following is a note of the rainfall registered at Lumgair:—

1889.

March.		April.		May.		June.		July.		Aug.		Sept.		Oct.		Nov.	
Date.	Inches. Decimals do.	Date.	Inches. Decimals do.	Date.	Inches. Decimals do.	Date.	Inches. Decimals do.	Date.	Inches. Decimals do.	Date.	Inches. Decimals do.	Date.	Inches. Decimals do	Date.	Inches. Decimals do.	Date.	Inches. Decimals do.
						2	.08	7	.17	4	.37	19	.27	1	.11	2	.05
						6	.39	8	.18	5	.40	27	.32	5	.50	4	.06
						9	.07	11	.27	6	.40			7	.39	9	.11
								15	.17	8	.21			9	.61	12	.05
								17	1.15	10	.31			11	.15	23	.33
								20	.08	11	1.50			12	.47	25	.21
								22	1.10	12	.76			16	.21		
								25	.22	14	.06			17	.18		
										16	.33			18	.46		
										17	.50			22	.38		
										20	.19			23	.27		
										21	1.16			24	.06		
										26	.18			25	.16		
										28	.49			26	.03		
														28	.18		
														29	.03		
														31	.06		
							·54		3 34		6.86		.59		4.25		.81

The rainfall was also registered at Johnston Lodge, and it would apply to the following farms: Leithfield, Townhead, Powburn, Mains of Mondynes, Pitdrichie, and Haddo:—

March.		April.		May.		June.		July.		Aug.		Sept.		Oct.		Nov.	
Date.	Inches. Decimals do.	Date.	Inches. Decimals do.	Date.	Inches. Decimals do.	Date.	Inches. Decimals do.	Date.	Inches. Decimals do.	Date.	Inches. Decimals do.	Date.	Inches. Decimals do.	Date.	Inches. Decimals do.	Date.	Inches. Decimals do.
2	.42	3	1.23	1	.01	1	.02	5	.12	4	.43	7	.01	4	.57	1	.03
3	.35	4	.82	3	.03	2	.50	6	.01	5	.59	9	.01	6	.57	2	.01
4	.06	5	.26	7	.02	3	.05	8	.44	6	.27	11	.01	7	.20	3	.03
6	.05	6	.18	17	.08	6	.35	10	.01	7	.01	13	.02	8	.11	4	.03
7	.15	7	.27	18	.01	7	01	12	.20	8	.21	18	.24	9	.12	8	.05
13	.01	8	.16	24	.11	8	.15	13	.01	10	2.25	20	.06	12	.24	9	.05
15	.01	9	.10	27	.07	9	.01	14	.28	11	1.10	21	.02	15	.24	15	.02
17	.34	10	.29	28	.53	12	.02	15	.25	13	.03	26	.07	16	.09	19	.02
18	.10	11	.48	29	.03	30	.03	16	.15	15	.07	27	.06	17	.40	21	.03
21	.52	12	.11	30	.02			17	.03	16	.58	30	.08	18	.15	22	.25
25	.01	13	.04	31	.05			21	.47	19	.02			19	.19	24	.13
28	.01	20	.12					25	.49	20	1.38			20	.09	26	.07
30	.18	22	.07					26	.03	22	.02			22	.97	27	.25
		23	.21					28	.01	24	.05			24	.10	30	.04
		24	.61							25	.02			26	.17		
		25	.01							26	.06			27	.03		
		26	.08							27	.52			28	.03		
		28	.42							28	.02			29	.05		
		30	.86							29	.01			30	.05		
	2.21		6.32		.96		1.14		2.50		7.64		.58		4.37		1.01

The experiments were all arranged on a uniform plan, each plot being one-fortieth part of an acre in extent. The experimenters got schedules drawn up by the Highland and Agricultural Society, with minute instructions for the carrying out of the various experiments.

The following is a note of the soil, subsoil, management, &c., of the various fields on which the experiments were carried out:—

Bush.—Light loam, on yellow subsoil. No farmyard manure was used. Sown, 5th June; singled, 4th to 7th July; lifted, 2d December. Purple-top yellow.

Upper Mills.—Six shift. Black loam on clay subsoil. Twenty-five loads farmyard manure applied in drill. Cattle getting grain and cake. Sown, 28th May; singled, 28th June; lifted, 3d December. Purple-top swede.

Green.—Six shift. Light black soil on pan subsoil. Thirteen tons farmyard manure applied in drill. Cattle getting 4 lb. mixed cake and grain each per day. Sown, 11th June; singled, 9th July; lifted, 11th December. Green-top yellow.

Newton.—Six shift. Light black soil on gravelly subsoil. Fifteen loads farmyard manure in drill. Sown, 8th June; singled, 5th July; lifted, 9th December. Green-top yellow.

Kirkton.—Six shift. Black light loam on gravelly subsoil. Twenty loads farmyard manure applied in drill. Cattle getting grain and cake. Sown, 5th June; singled, 4th July; lifted, 17th December.

Mains of Raemoir.—Six shift. Light brown soil on rock. Seventeen loads farmyard manure applied in drill. Cattle getting 5 lb. linseed-cake and grain mixed. Sown, 5th June; singled, 3d July; lifted, 9th December. In Experiment III. plots 5, 6, and 7 were on the worst land, and in Experiment IV. plot 1 was on the worst land. In Experiment II. plot 10 was on the best land.

Bishopston.—Six shift. Mixed black loam on pan subsoil. Twenty tons farmyard manure applied in drill. Cows getting 2 lb. bean-meal and one bushel draff. Sown, 27th May; singled, 1st July; lifted, 16th November. Tops and bulbs weighed together.

Badentoy.—Six shift. Light brown soil on pan subsoil. Twenty tons of farmyard manure applied in drill. Cows getting one bushel of draff and 2 lb. bean-meal. Sown, 1st June; singled, 9th July; lifted, 16th November. Tops and bulbs weighed together.

Balquharn.—Six shift. Black loam on clay subsoil. Twenty-five tons of farmyard manure applied in drill. Cows getting 2 lb. bean-meal and one bushel draff. Sown, 27th May; singled, 4th July; lifted, 15th November. Tops and bulbs weighed together.

Easter Muchalls.—Five shift. Free brown soil on gravelly subsoil. Twenty loads farmyard manure applied in drill. Cattle getting cake and grain. Sown, 20th May; singled, 27th June; lifted, 16th November. Tops and bulbs weighed together. Green-top yellow.

Westport.—Seven shift (four grasses). Strong brown loam on clay subsoil. Twenty loads of farmyard manure applied in drill. Cattle getting 2 lb. of mixed cake. Sown, 12th June; singled, 23d July; lifted, 16th November. Tops and bulbs weighed together in No. 2 Experiment, and they were weighed separate in Experiments 3 and 4. Green-top yellow.

Logie.—Five shift. Brown loam on clay subsoil. Seventeen loads of farmyard manure applied in drill. Cattle getting cake. Sown, 20th May; singled, 27th June; lifted, 3d December. No. 2 Experiment. Green-top yellow and 3 and 4 purple-top swede.

Wester Logie.—Five shift. Light brown loam on rocky subsoil. Sixteen loads farmyard manure applied in drill. Cattle getting grain and cake. Sown, 18th May; singled, 1st July; lifted, 16th November.

Auquhirie.—Five shift. Brown light dry soil in poor condition, on gravelly subsoil. No farmyard manure applied, and it had got none for the last ten years. Sown, 15th June; singled, 20th July; lifted, 25th December. Green-top yellow.

Uras. — Five shift. Medium loam on gravelly subsoil. Fifteen loads farmyard manure applied in drill. Sown, 5th June, 1889; singled, 12th July; lifted, 4th December. There was a considerable amount of finger-and-toe in the superphosphate plots.

Hallhill.—Five shift. Black loam on hard rocky subsoil. Fifteen loads farmyard manure applied in drill. Cattle getting cake and corn. Sown, 8th June; singled, 12th July; lifted, 3d December. Plots 4 and 9 were on the worst lands.

Swinewaird.—Five shift. Brown strong loam on clay subsoil. Fifteen loads farmyard manure applied in drill. Sown, 3d June; singled, 4th July; lifted, 5th December. Green-top yellow.

Leithfield.—Seven shift (2 green, 2 grass, 3 grains). Red sandy loam on sandy subsoil. Fifteen loads farmyard manure applied in drill (partly made under covered court). Cattle getting cake and grain. Sown, 8th June; singled, 4th July; lifted, 10th December.

Townhead.—Seven shift (3 grasses, 3 grains, and 1 green). Black loam on sandy clay. Farmyard manure made under cover applied in drill. Sown, 8th June; singled, 8th July; lifted, 21st December.

Powburn.—Seven shift. Friable loam on clay subsoil (seven years ago lime was applied to this field at the rate of three tons to the acre). Twenty loads dung made under cover applied in the drill. The previous grain crop was manured with a mixture of bone-meal, bone-flour, nitrate of soda, nitrate of potash, and kainit, at the rate of 3½ cwts. per acre. Sown, 1st June; singled, 6th to 12th July; lifted, 20th December.

Mains of Mondynes—Six shift. Sharp black soil on red pan subsoil. Twenty loads farmyard manure kept under covered courts applied in drill. Cattle getting about 5 lb. mixed cake and grain. Sown, 5th June; singled, 26th June; lifted, 21st December.

Pitdrichie.—Six shift. Sandy soil on gravelly subsoil. Fifteen loads farmyard manure applied in drill (kept partly under cover). Cattle getting 4 lb. of mixed cake and grain. Sown, 7th June; singled, 28th June; lifted, 20th December.

East Mathers.—Six shift (3 grains, 2 greens, 1 grass). Black loam on sandy subsoil. No farmyard manure applied. Sown, 13th June; singled, 9th July; lifted, 26th December.

Haddo.—Six shift. Red loam on strong clay subsoil. No farmyard manure used. Sown, 8th June; singled, 4th July; lifted, 20th December.

Causeyport.—Five shift. Black loam with slight tinge of clay, on clay subsoil. Twenty loads farmyard manure applied in drill. Cows getting one bushel draff. Sown, 8th June; singled, 8th July; lifted, 25th November. Tops and bulbs weighed. Green-top yellow.

Mains of Findon.—Five shift. Medium loam on strong mixed subsoil. Twenty loads farmyard manure applied per acre in drill. Cattle getting cake. Sown, 21st May; singled, 21st June; lifted, 6th November. Green-top yellow. Plots Nos. 1, 2, 3, and 4 were on rather better land than plots 5, 6, 7, and 8 in Experiment III.

Craighead.—Five shift. Mixed black loam on pan. Twenty loads farmyard manure applied in drill. Cows getting one bushel draff and 2 lb. bean-meal. Sown, 1st June; singled, 8th July; lifted, 16th November. Green-top yellow.

Mains of Dunnottar.—Six shift. Friable black loam on gravel subsoil. Twenty-two loads farmyard manure applied in drill. Cattle getting 4 lb. cake and corn. Sown, 3d June; singled, 8th July; lifted, 5th December.

Nether Criggie.—Five shift. Light loam on a brown pan gravelly subsoil. Seventeen loads farmyard manure applied in drill. Cattle getting cake and corn. Sown, 22d May; singled, 27th June; lifted, 5th December.

Crossgates.—Five shift. Friable loam on damp sand and gravel subsoil. Thirteen loads farmyard manure applied in drill. Cattle getting small quantity of cake and corn. Sown, 23d May; singled, 24th June; lifted, 6th December.

East Mains of Barras.—Five shift. Light loam soil, clay subsoil. Sixteen loads farmyard manure, kept under cover, applied in drill. Cattle getting corn and cake. Sown, 18th May; singled, 15th June; lifted, 5th December.

Slains.—Five shift. Light black loam on clay subsoil. Fifteen loads farmyard manure applied in drill. The spring-manured plots had rather the best land; there was a considerable amount of finger-and-toe in the slag plots, while the other plots were free from it. Sown, 27th May; singled, 27th June; lifted, 5th December.

West Newtonleys.—Five shift. Friable black soil on red pan. The land on which No. 3 Experiment was on was very dry, and the spring plots were on the worst land. Sixteen loads farmyard manure applied in drill. Cattle getting 3 lb. linseed-cake. Sown, 20th May; singled, 25th June; lifted, 5th December.

Cairnwell.—Five shift. Loam with little moss on clay subsoil. Fifteen loads farmyard manure applied in drill. Cattle getting about 2 lb. cake. Sown, 27th May; singled, 4th July; lifted, 16th November.

Easterside.—Five shift. Black soil on close gravelly subsoil. Seventeen loads farmyard manure applied in drill. Sown, 10th June; singled, 8th July; lifted, 6th December. Green-top yellow.

Druidsdale.—Five shift. Moory soil on pan clay subsoil. No farmyard manure was used. Sown, 10th June; singled, 9th July; lifted, 6th December. In Experiment IV. plots 2 and 6 were on considerably worse land than the others. Green-top yellow.

Mains of Catterline.—Five shift. Strong loam soil on sandy clay subsoil. In Experiment III. no farmyard manure was given except to plot 5, which got at the rate of seventeen loads. Cattle getting cake and corn. The manure being sown in drill at time of sowing turnips. In No. IV. Experiment the manure was applied in March, and the plots got at the rate of seventeen loads farmyard manure at date of sowing turnip-seed. Sown, 20th May; singled, 20th June; lifted, 6th December. Purple-top swede.

Catterloch.—Six shift. Sharp light land on damp gravelly pan subsoil. Twenty loads farmyard manure applied in drill; the manure was applied in the drill at time of sowing in both III. and IV. Experiments on this farm. Sown, 18th June; singled, 12th July; lifted, 2d December. Green-top yellow.

Lumgair.—Five shift. Heavy loam on clay subsoil. Twenty loads farmyard manure in drill. Cattle getting 5 lb. mixed cake and grain. Sown, 17th May; singled, 27th June; lifted, 6th December. Green-top swede.

Kernoon.—Five shift. Black moory light soil on pan subsoil. Eighteen loads farmyard manure in drill. Cattle getting cake and corn. Sown, 20th May; singled, 29th June; lifted, 6th December.

Newtonleys.—Six shift. Light brown soil on gravelly subsoil. Twenty-five loads farmyard manure in drill. Sown, 21st May; singled, 23d June; lifted, 10th December.

Law of Lumgair.—Six shift. Light black land on pan subsoil. Fifteen loads farmyard manure in drill. Manures of Experiment III. were sown in autumn, and Experiment IV. were sown in spring.

EXPERIMENT II.

This is the first experiment undertaken during the past season, its object being to discover the most appropriate and economical turnip manure:—

1. Should the phosphates be soluble or insoluble?
2. Should the phosphates consist of bone, mineral phosphate, or Thomas-slag?
3. Should the nitrogenous manure be soluble or insoluble, or a mixture of these?
4. What proportion should the phosphates bear to the nitrogen?

The manures applied in this experiment are so arranged that each plot receives the same amount of phosphates and ammonia —viz., 200 lb. phosphate of lime and 20 lb. ammonia per acre. These being the amounts (per acre) of phosphates of lime and ammonia contained in the bone-meal applied to plot No. 1, all the other plots are made up to that standard, except plot 6, which gets no phosphate, and plots 9 and 10, in which the proportions of ammonia are reduced to three-fourths and one-half the standard amounts respectively.

This experiment was carried out on twenty-three farms throughout the country, the plots being arranged and manured as shown by the following diagram:—

	1.	2.	3.
Kind and weight of manures applied per plot.	Fine bone-meal, 10 lb.	Vitriolated bones, 13½ lb. Organic manure, 1½ lb.	Ground Charleston phosphate, 9 lb. Organic manure, 7 lb.
Cost per acre . . .	21s. 6d.	28s. 6d.	18s.
	4.	**5.**	**6.**
Kind and weight of manures applied per plot.	Superphosphate, 17 lb. Organic manure, 7 lb.	Thomas-slag, 13½ lb. Organic manure, 7 lb.	Organic manure, 7 lb.
Cost per acre . . .	23s. 6d.	17s. 6d.	8s. 6d.
	7.	**8.**	**9.**
Kind and weight of manures applied per plot.	Superphosphate, 17 lb. Organic manure, 3½ lb. Sulphate of ammonia, 1 lb.	Superphosphate, 17 lb. Sulphate of ammonia, 2 lb.	Superphosphate, 17 lb. Sulphate of ammonia, 1½ lb.
Cost per acre . . .	24s.	24s.	22s.
	10.	**11.**	
Kind and weight of manures applied per plot.	Superphosphate, 17 lb. Sulphate of ammonia, 1 lb.	No artificial manure.	
Cost per acre . . .	20s.		

Plot.	Bush.					Bush (*turnip-tops*).					Upper Mills.				
	Weight per acre.		Value per acre, at 5d. per cwt.			Weight per acre.		Value per acre, at 3d. per cwt.			Weight per acre.		Value per acre, at 5d. per cwt.		
	cwt.	lb.	£	*s.*	*d.*	cwt.	lb.	£	*s.*	*d*	cwt	lb.	£	*s.*	*d.*
1	216	88	4	10	3	32	28	0	8	1	397	16	8	5	5
2	308	84	6	8	7	37	36	0	9	4	440	80	9	2	7
3	246	88	5	2	9	32	16	0	8	0	361	48	7	10	7
4	251	8	5	4	7	29	12	0	7	3	437	16	9	2	1
5	230	40	4	15	11	31	28	0	7	10	421	48	8	15	6
6	84	72	0	15	3	15	100	0	3	11	345	80	7	4	0
7	357	86	7	9	0	43	84	0	10	11	456	48	9	10	0
8	306	68	6	7	8	45	60	0	11	4	452	16	9	8	4
9	192	56	4	0	2	26	108	0	6	8	442	16	9	4	2
10	183	54	3	16	3	30	20	0	7	6	421	48	8	15	6

Plot.	Upper Mills (*turnip-tops*).					Green.					Newton.				
	Weight per acre.		Value per acre, at 3d. per cwt.			Weight per acre.		Value per acre, at 5d. per cwt.			Weight er acre.		Value per acre, at 5d. per cwt.		
	cwt.	lb.	£	s.	d.	cwt.	lb.	£	s.	d.	cwt.	lb.	£	s.	d.
1	60	0	0	15	0	354	32	7	7	6	303	104	6	6	7
2	58	64	0	14	7	459	32	9	11	3	345	40	7	3	10
3	50	0	0	12	6	396	48	8	5	0	315	80	6	11	5
4	53	64	0	13	4	454	72	9	9	2	293	64	6	2	3
5	54	32	0	13	7	408	64	8	10	2	299	32	6	4	8
6	50	0	0	12	6	292	96	6	1	8	181	48	3	15	6
7	62	96	0	15	8	482	96	10	1	2	374	32	7	15	10
8	57	16	0	14	3	467	96	9	14	11	367	16	7	12	11
9	55	0	0	13	9	433	64	9	0	7	338	64	7	1	0
10	53	64	0	13	4	436	48	9	1	8	283	64	5	18	0
11	...		...			365	80	7	12	3					

Plot.	Kirkton.					Mains of Raemoir.					Bishopston.				
			At 5d.												
1	398	64	8	6	0	340	0	7	1	8	405	80	8	9	0
2	445	80	9	5	5	408	64	8	10	2	531	48	11	1	5
3	434	32	9	0	11	334	32	6	19	3	375	80	7	16	6
4	406	8	8	9	2	358	64	7	9	4	451	48	9	8	0
5	406	8	8	9	2	392	96	8	3	9	501	48	10	8	10
6	382	96	7	19	6	388	64	8	1	10	434	64	9	1	0
7	437	96	9	2	4	477	16	9	18	10	560	0	11	13	4
8	444	72	9	5	0	391	48	8	3	1	440	0	9	3	4
9	406	48	8	9	2	388	64	8	1	10	468	64	9	15	3
10	433	104	9	0	9	425	80	8	17	3	495	80	10	6	6

Plot.	Badentoy.					Easter Muchalls.					Westport.				
			At 5d.												
1	440	0	9	3	4	400	0	8	6	8	357	16	7	8	9
2	485	80	10	2	4	560	0	11	13	4	394	32	8	4	3
3	434	32	9	0	11	520	0	10	16	8	331	48	6	17	11
4	385	80	8	0	8	560	0	11	13	4	562	96	11	14	5
5	382	96	7	19	6	600	0	12	10	0	402	96	8	7	9
6	502	96	10	9	6	360	0	7	10	0	451	48	9	8	1
7	528	64	11	0	2	440	0	9	3	4	542	96	11	6	1
8	528	64	11	0	2	480	0	10	0	0	640	0	13	6	8
9	497	16	10	7	1	480	0	10	0	0	722	96	15	1	2
10	502	96	10	9	6	360	0	7	10	0	482	96	10	1	2

Plot.	LOGIE.					WESTER LOGIE.					AUQUHIRIE.				
	Weight per acre.		Value per acre, at 5d. per cwt.			Weight per acre.		Value per acre, at 5d. per cwt.			Weight per acre.		Value per acre, at 5d. per cwt.		
	cwt.	lb.	£	s.	d.	cwt	lb.	£	s.	d.	cwt.	lb.	£	s	d.
1	360	0	7	10	0	425	80	8	17	4	197	16	4	2	1
2	480	0	10	0	0	534	32	11	2	7	228	64	4	15	2
3	400	0	8	6	8	480	0	10	0	0	168	64	3	10	2
4	468	64	9	15	3	508	64	10	11	8	209	32	4	7	2
5	530	0	11	0	10	470	0	9	15	10	240	0	5	0	0
6	320	0	6	13	4	400	0	8	6	8	105	0	2	3	9
7	480	0	10	0	0	490	0	10	4	2	222	96	4	12	10
8	468	64	9	15	0	567	16	11	16	3	162	96	3	7	10
9	530	0	11	0	10	490	0	10	4	2	191	48	3	19	9
10	360	0	7	10	0	414	32	8	12	6	238	64	4	19	4
	URAS.					HALLHILL.					SWINEWAIRD.				
1	325	40	6	15	6	364	32	7	11	9	488	64	10	3	6
2	325	0	6	15	5	363	64	7	11	5	528	64	11	0	2
3	430	0	8	19	2	390	0	8	2	6	542	96	11	6	1
4	370	80	7	14	5	306	48	6	7	6	580	0	12	1	8
5	363	24	7	11	3	410	0	8	10	10	480	0	10	0	0
6	360	80	7	10	2	381	48	7	18	9	420	0	8	15	0
7	371	8	7	14	7	393	64	8	3	9	517	16	10	15	5
8	349	72	7	5	7	420	0	8	15	0	600	0	12	10	0
9	421	88	8	15	5	377	16	7	17	1	600	0	12	10	0
10	371	48	7	14	7	460	0	9	11	8	485	80	10	2	3
11	...		...			...		...			414	32	8	12	7
	LEITHFIELD.					TOWNHEAD.					TOWNHEAD (*turnip-tops*).				
													At 3d.		
1	512	16	10	13	4	351	48	7	6	5	38	64	0	9	7
2	612	96	12	15	3	377	16	7	17	1	40	0	0	10	0
3	532	96	11	1	11	363	64	7	11	5	41	48	0	10	4
4	579	96	12	1	6	375	0	7	16	3	37	16	0	9	3
5	595	0	12	7	11	406	88	8	9	5	45	0	0	11	3
6	499	32	10	8	2	382	96	7	19	6	45	80	0	11	5
7	564	52	11	15	2	392	16	8	3	4	42	16	0	10	6
8	540	0	11	5	0	427	96	8	17	11	48	64	0	12	1
9	588	64	12	5	2	377	96	7	17	1	41	48	0	10	4
10	585	80	12	3	11	395	0	8	4	7	52	96	0	13	2
11	549	32	11	8	10	...		...			...		...		

Plot.	Powburn.					Mains of Mondynes.					Pitdrichie.				
	Weight per acre.		Value per acre, at 5d. per cwt.			Weight per acre.		Value per acre, at 5d. per cwt.			Weight per acre.		Value per acre, at 5d. per cwt.		
	cwt.	lb.	£	s.	d.	cwt.	lb.	£	s.	d.	cwt.	lb.	£	s.	d.
1	498	10	10	7	6	610	0	12	14	2	310	80	6	9	5
2	520	0	10	16	8	597	16	12	8	9	391	8	8	2	11
3	505	10	10	10	5	575	80	11	19	9	349	32	7	5	6
4	544	40	11	6	8	570	80	11	17	8	354	72	7	7	6
5	560	0	11	13	4	581	48	12	2	1	262	56	5	9	4
6	507	11	10	11	3	567	16	11	16	3	305	40	6	7	1
7	496	0	10	6	8	592	96	12	7	0	405	0	8	8	9
8	550	20	11	9	2	643	64	13	8	2	366	48	7	12	8
9	535	42	11	3	0	568	64	11	16	10	368	48	7	13	6
10	501	10	10	8	9	560	0	11	13	4	323	64	6	14	9
11	544	40	11	6	8	605	0	12	12	1	243	24	5	1	3
	East Mathers.					Haddo.									
1	237	16	4	18	9	220	80	4	11	10					
2	258	64	5	7	8	272	64	5	14	0					
3	235	80	4	18	2	233	24	4	17	2					
4	294	32	6	2	7	232	16	4	16	8					
5	337	16	7	0	5	240	0	5	0	0					
6	240	0	5	0	0	192	56	4	0	2					
7	278	64	5	16	0	275	0	5	14	7					
8	282	96	5	17	9	285	0	5	18	9					
9	345	80	7	4	0	306	48	6	7	8					
10	354	32	7	7	7	260	0	5	8	4					

The next experiment undertaken was No. III., which was carried out on twenty-four different farms. The objects of this experiment are:—

1. To discover how Thomas-slag compares with superphosphate as a manure for turnips.
2. To discover how much the Thomas-slag is increased in its efficacy by being very finely ground.
3. To discover whether it is more advantageous to apply these phosphates in autumn or spring.

This experiment was laid out and manured as shown by the subjoined diagram. To plots 1 and 5 Thomas-slag of ordinary fineness—viz., 80 per cent passing through No. 100 wire-cloth—was applied. To plots 2 and 6, Thomas-slag, very finely ground—viz., 80 per cent passing through No. 150 wire-cloth—was applied. To plots 3 and 7, superphosphate, 26 per cent soluble, was applied. No artificial manure was applied to plots 4 and 8.

The manure was applied to the autumn plots—viz., 1, 2, and 3—in the month of March; and the spring-manured plots—viz., 5, 6, and 7—were manured at the time of sowing.

AUTUMN.

	1.	2.	3.	4.
Kind and weight of manure applied.	Coarse slag, 18 lb.	Fine slag, 15½ lb.	Superphosphates, 10 lb.	No artificial manure.
Cost per acre . . .	10s. 6d.	10s. 6d.	10s. 6d.	

SPRING.

	5.	6.	7.	8.
Kind and weight of manure applied.	Coarse slag, 18 lb.	Fine slag, 15½ lb.	Superphosphates, 10 lb.	No artificial manure.
Cost per acre . . .	10s. 6d.	10s. 6d.	10s. 6d.	

EXPERIMENT III.

	1. WESTER LOGIE.				2. WESTPORT.			
Plot.	Weight per acre.	Gain by application of Manure.	Loss by application of Manure.	Value of difference at 5d. per cwt.	Weight per acre.	Gain by application of Manure.	Loss by application of Manure.	Value of difference at 5d. per cwt.
	cwt. lb.	cwt. lb.	cwt. lb.	s. d.	cwt. lb.	cwt. lb.	cwt. lb.	s. d.
1	397 16	...	22 12	9 2	433 64	13 64	...	5 7
2	400 0	...	20 0	8 4	363 84	...	56 28	23 5
3	362 96	...	57 12	23 9	408 64	...	11 48	4 9
4	420 0	...	...	...	420 0	...	...	...
5	402 96	8 64	...	3 6	456 88	21 108	...	9 0
6	417 16	22 96	...	9 6	459 32	24 52	...	10 2
7	395 80	1 48	...	0 7	473 84	38 104	...	16 3
8	394 32	...	...	...	434 92	...	...	...
	3. CAUSEYPORT.				4. MAINS OF FINDON.			
1	351 48	...	92 16	38 4	525 80	...	17 16	7 1
2	374 32	...	69 32	28 10	520 0	...	22 96	9 6
3	474 32	30 80	...	12 9	514 32	...	28 64	11 10
4	443 64	...	...	...	542 96	...	...	...
5	442 96	...	0 80	0 3	600 0	102 96	...	42 10
6	530 0	86 48	...	36 0	554 32	57 16	..	23 9
7	500 0	56 48	...	23 6	622 96	125 80	...	52 4
8	443 64	...	...	...	497 16	...	...	...

EXPERIMENT III.—*continued.*

	5. CRAIGHEAD.				6. BISHOPSTON.			
Plot.	Weight per acre.	Gain by application of Manure.	Loss by application of Manure.	Value of difference at 5d. per cwt.	Weight per acre.	Gain by application of Manure.	Loss by application of Manure.	Value of difference at 5d. per cwt.
	cwt. lb.	cwt. lb.	cwt. lb.	s. d.	cwt. lb.	cwt. lb.	cwt. lb.	s. d.
1	534 32	80 0	...	33 4	412 96	...	35 16	14 7
2	547 16	92 96	...	38 8	410 0	...	38 64	16 0
3	554 32	100 0	...	41 8	415 80	...	32 96	13 8
4	454 32	...	...	...	448 64	...	...	...
5	527 16	118 64	...	49 4	472 96	15 80	...	6 6
6	530 0	121 48	...	50 7	384 32	...	72 96	30 4
7	527 16	118 64	...	49 4	444 32	...	12 96	5 4
8	408 64	...	...	...	457 16	...	...	...
	7. MAINS OF RAEMOIR.				8. MAINS OF DUNNOTTAR.			
1	512 96	148 64	...	61 11	355 80	...	7 16	2 11
2	467 96	103 64	...	43 2	340 0	...	22 96	9 6
3	398 64	34 32	...	14 3	337 96	...	25 0	10 5
4	364 0	...	...	...	362 96	...	...	...
5	403 64	13 64	...	5 8	328 64	67 96	...	28 3
6	430 80	40 80	...	16 11	325 0	64 32	...	26 9
7	434 32	44 32	...	18 5	277 16	16 48	...	6 10
8	390 0	...	...	...	260 80	...	...	...
	9. NETHER CRIGGIE.				10. CROSSGATES.			
1	420 0	82 96	...	34 6	409 72	63 24	...	26 4
2	381 48	44 32	...	18 5	383 84	37 36	...	15 6
3	397 16	60 0	...	25 0	373 104	27 56	...	11 5
4	337 16	...	...	...	346 48	...	...	...
5	392 96	64 32	...	26 9	430 40	64 52	...	26 10
6	387 16	58 64	...	24 5	442 96	76 108	...	32 0
7	381 48	52 96	...	22 0	420 40	54 52	...	22 8
8	328 64	...	...	...	365 100	...	...	...
	11. EAST MAINS OF BARRAS.				12. SLAINS.			
1	400 0	...	22 96	9 6	505 80	161 48	...	67 3
2	431 48	8 64	...	3 7	518 64	174 32	...	72 7
3	385 80	...	37 16	15 5	387 16	42 96	...	17 9
4	422 96	...	...	...	344 32	...	...	...
5	468 64	45 80	...	19 0	515 80	135 80	...	56 6
6	462 96	40 0	...	16 8	578 64	198 64	...	82 9
7	391 48	...	31 48	13 0	430 0	50 0	...	20 10
8	422 96	...	...	...	380 0	...	...	...

Experiment III.—*continued.*

Plot.	Weight per acre.	Gain by application of Manure.	Loss by application of Manure.	Value of difference at 5d. per cwt.	Weight per acre.	Gain by application of Manure.	Loss by application of Manure.	Value of difference at 5d. per cwt.
	13. West Newtonleys.				14. Logie.			
	cwt. lb.	cwt. lb.	cwt. lb.	s. d.	cwt. lb.	cwt. lb.	cwt. lb.	s. d.
1	414 32	...	21 48	8 11	440 0	62 96	...	26 2
2	433 64	...	2 16	0 10	420 0	42 96	...	17 10
3	410 80	...	25 0	10 5	428 64	51 48	...	21 5
4	435 80	...	...	...	377 16	...	...	...
5	360 0	...	49 32	20 5	320 0	...	57 96	24 2
6	367 90	...	41 48	17 3	440 0	62 16	...	25 10
7	369 32	...	40 32	16 9	380 0	2 16	...	0 10
8	409 32	...	...	...	377 96	...	...	...
	15. Cairnwell.				16. Balquharn.			
1	380 0	. .	68 96	28 9	577 16	...	39 12	16 3
2	465 0	16 16	...	6 8	471 48	...	144 92	60 4
3	400 0	...	48 96	20 4	691 48	75 20	...	31 3
4	448 96	...	...	...	616 28	...	...	...
5	330 0	...	36 16	15 0	597 16	5 80	...	2 4
6	340 0	...	26 14	10 10	548 64	...	42 96	17 10
7	408 0	41 96	...	17 5	708 64	117 16	...	48 9
8	366 16	...	...	...	591 48	...	...	...
	17. Easterside.				18. Druidsdale.			
1	377 16	80 0	...	33 4	288 64	50 0	...	20 10
2	400 0	102 96	...	42 11	338 64	100 0	...	41 8
3	342 96	45 80	...	19 0	335 80	97 16	...	40 5
4	297 16	...	...	...	238 64	...	...	...
5	405 80	57 16	...	23 9	301 48	62 96	...	26 4
6	497 16	148 62	...	61 10	337 16	98 64	...	41 0
7	365 80	17 16	...	7 1	375 80	137 16	...	57 1
8	348 64	...	...	...	238 64	...	...	...
	19. Mains of Catterline.				20. Lumgair.			
1	494 32	110 0	...	45 10	266 8	27 56	...	11 5
2	524 32	140 0	...	58 4	312 56	73 104	...	30 9
3	520 0	135 80	...	56 6	315 0	76 48	...	31 10
4	384 32	...	...	...	238 64	...	...	...
5	517 16	132 96	...	55 3	326 48	8 64	...	3 6
6	...	...	...	...	336 48	18 64	..	7 8
7	...	...	...	...	339 32	21 48	...	8 11
8	...	...	...	...	317 96	...	...	...

Experiment III.—*continued.*

	21. Kernoon.				22. Newtonleys.			
Plot.	Weight per acre.	Gain by application of Manure.	Loss by application of Manure.	Value of difference at 5d. per cwt.	Weight per acre.	Gain by application of Manure.	Loss by application of Manure.	Value of difference at 5d. per cwt.
	cwt. lb.	cwt. lb.	cwt. lb.	*s.* *d.*	cwt. lb.	cwt. lb.	cwt. lb.	*s.* *d.*
1	299 32	...	3 64	1 5	520 0	...	70 0	29 2
2	326 48	23 64	...	9 9	540 0	...	50 0	20 10
3	282 16	...	20 80	8 7	550 0	...	40 0	16 8
4	302 96	...	...	...	590 0	...	...	...
5	367 96	28 54	...	11 10	570 0	...	20 0	8 4
6	347 96	8 54	...	3 6	560 0	...	30 0	12 6
7	331 48	...	7 106	3 3	540 0	...	50 0	20 10
8	339 42	...	...	...	590 0	..	...	...

	23. Law of Lumgair.				24. Uras.			
1	359 32	22 96	...	9 6	294 32	...	41 48	17 3
2	368 64	32 16	...	13 4	328 64	...	7 16	2 11
3	365 80	29 32	...	12 2	184 72	...	151 18	62 11
4	336 48	...	...	...	335 80	...	...	...
5	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...

	1. Westport (*turnip-tops*).			
				At 3d.
1	99 32	...	14 32	3 6
2	96 48	...	17 16	4 3
3	85 60	. .	28 4	7 0
4	113 64	...	..	...
5	100 80	...	29 32	7 3
6	101 48	...	28 64	7 1
7	104 32	...	25 80	6 5
8	130 0	...	...	...

The next and last experiment undertaken was No. 4; it was also carried out on twenty-four different farms. The objects of this experiment are:—

1. To discover whether fine bone-meal or steamed bone-flour is the more profitable manure for turnips.
2. To discover how these compare with superphosphate.
3. To discover whether it is more advantageous to apply them in autumn or spring.

This experiment was laid out and manured as shown by the subjoined diagram:—To plots 1 and 5, fine ground bone-meal, 80 per cent passing through a $\frac{1}{8}$-inch sieve. To plots 2 and 6 steamed bone-flour and meat-meal was applied, and to plots 3 and 7 superphosphate and meat-meal was applied. To plots 4 and 8 no phosphate was applied, but they got the same amount of meat-meal as plots 3 and 7.

The manure was applied to the autumn plots—viz., 1, 2, 3, and 4—in the month of March; and the spring-manured plots—viz., 5, 6, 7, and 8—were manured at time of sowing the turnip seed.

AUTUMN.

	1.	2.	3.	4.
Kind and weight of manure applied.	Bone-meal, 13 lb.	Steamed bone-flour, 12 lb. Meat-meal, 2 lb. 2 oz.	Superphosphate, 18 lb. 5 oz. Meat-meal, 4 lb. 8 oz.	Meat-meal, 4 lb. 8 oz
Cost per acre . .	25s.	25s.	25s.	

SPRING.

	5.	6.	7.	8.
Kind and weight of manure applied.	Bone-meal, 13 lb.	Steamed bone-flour, 12 lb. Meat-meal, 2 lb. 2 oz.	Superphosphate, 18 lb. 5 oz. Meat-meal, 4 lb. 8 oz.	Meat-meal, 4 lb. 8 oz.
Cost per acre . .	25s.	25s.	25s.	

EXPERIMENT IV.

	1. WESTER LOGIE.				2. WESTPORT.			
Plot.	Weight per acre.	Gain by application of Manure.	Loss by application of Manure.	Value of difference at 5d. per cwt.	Weight per acre.	Gain by application of Manure.	Loss by application of Manure.	Value of difference at 5d. per cwt.
	cwt. lb.	cwt. lb.	cwt. lb.	s. d.	cwt. lb.	cwt. lb.	cwt. lb.	s. d.
1	437 16	...	50 0	20 10	393 64	...	0 80	0 3
2	422 96	...	64 32	26 9	322 96	...	71 48	29 9
3	442 96	...	44 32	18 5	363 64	...	30 80	12 9
4	487 16	...	...	...	394 32	...	...	...
5	402 96	...	37 16	15 5	411 85	101 48	...	42 2
6	382 96	...	57 16	23 9	414 12	94 12	...	39 2
7	420 0	...	20 0	8 4	368 64	58 64	...	24 4
[8	440 0	...	...	...	310 0	...	...	...

EXPERIMENT IV.—*continued.*

	3. CAUSEYPORT.				4. MAINS OF FINDON.			
Plot.	Weight per acre.	Gain by application of Manure.	Loss by application of Manure.	Value of difference at 5d. per cwt.	Weight per acre.	Gain by application of Manure.	Loss by application of Manure.	Value of difference at 5d. per cwt.
	cwt. lb.	cwt. lb.	cwt. lb.	*s. d.*	cwt. lb.	cwt. lb.	cwt. lb.	*s. d.*
1	517 16	174 32	...	72 7	462 96	...	22 96	9 6
2	470 0	127 16	...	52 11	565 80	80 0	...	33 4
3	520 0	177 16	...	73 9	560 0	74 32	...	30 11
4	342 96	...	...	...	485 80	...	...	...
5	514 32	144 32	...	60 1	434 32	...	28 64	11 10
6	528 64	158 64	...	66 0	531 48	68 64	...	28 6
7	580 0	210 0	...	87 6	560 0	97 16	..	40 5
8	370 0	...	...	...	462 96	...	...	...
	5. CRAIGHEAD.				6. BISHOPSTONE.			
1	475 80	67 16	...	27 11	434 32	...	100 80	41 11
2	504 32	95 80	...	39 10	470 0	...	65 0	27 1
3	611 48	202 96	...	84 6	545 80	10 80	...	4 5
4	408 64	...	...	...	535 0	...	...	...
5	544 32	95 80	...	39 10	428 64	...	108 64	45 2
6	477 16	28 64	...	11 10	425 80	...	111 48	46 5
7	567 16	118 64	...	49 4	432 96	...	104 32	43 5
8	448 64	...	...	...	...	...	...	...
	7. MAINS OF RAEMOIR.				8. MAINS OF DUNNOTTAR.			
1	329 32	...	20 40	8 5	407 96	55 0	...	22 11
2	387 96	38 24	...	15 10	416 48	63 64	...	26 5
3	455 80	106 8	...	44 2	377 96	25 0	...	10 5
4	349 72	...	...	...	352 96	...	...	...
5	419 32	123 61	...	51 5	328 64	67 96	...	28 3
6	352 16	56 48	...	23 6	325 0	64 32	...	26 9
7	366 8	70 40	...	29 3	277 16	16 48	...	6 9
8	295 80	...	...	...	260 80	...	...	...
	9. NETHER CRIGGIE.				10. CROSSGATES.			
1	411 48	35 80	...	14 10	410 0	49 32	...	20 6
2	370 0	...	5 80	2 4	409 72	48 104	...	20 4
3	370 0	...	5 80	2 4	452 56	91 88	...	38 3
4	375 80	...	...	...	360 80	...	...	...
5	377 16	...	25 80	10 8	405 20	...	35 60	14 9
6	405 80	2 96	...	1 2	441 28	0 60	...	0 2
7	442 96	40 0	...	16 8	481 28	40 60	...	16 10
8	402 96	...	...	...	440 80	...	...	...

EXPERIMENT IV.—*continued.*

11. EAST MAINS OF BARRAS.

Plot.	Weight per acre.		Gain by application of Manure.		Loss by application of Manure.		Value of difference at 5d. per cwt.	
	cwt.	lb.	cwt.	lb.	cwt.	lb.	s.	d.
1	508	64	22	96	...		9	6
2	525	80	40	0	...		16	8
3	440	0	...		45	80	19	0
4	485	80	...		...		...	
5	411	48	...		42	96	17	10
6	525	80	71	48	...		29	9
7	540	0	85	80	...		35	8
8	454	32	...		...		...	

12. SLAINS.

Plot.	Weight per acre.		Gain by application of Manure.		Loss by application of Manure.		Value of difference at 5d. per cwt.	
	cwt.	lb.	cwt.	lb.	cwt.	lb.	s.	d.
1	488	64	110	0	...		45	10
2	487	16	108	64	...		45	2
3	431	48	52	96	...		22	0
4	378	64	...		...		...	
5	512	96	162	96	...		67	10
6	492	96	142	96	...		59	6
7	454	32	104	32	...		43	5
8	350	0	...		...		...	

13. WEST NEWTONLEYS.

Plot.	Weight per acre.		Gain by application of Manure.		Loss by application of Manure.		Value of difference at 5d. per cwt.	
1	410	80	89	32	...		37	2
2	434	32	112	96	...		47	0
3	358	64	37	16	...		15	5
4	321	48	...		...		...	
5	482	16	119	32	...		49	8
6	513	64	150	80	...		62	9
7	437	16	74	32	...		30	11
8	362	96	...		...		...	

14. LOGIE.

Plot.	Weight per acre.		Gain by application of Manure.		Loss by application of Manure.		Value of difference at 5d. per cwt.	
1	377	0	...		23	0	9	7
2	400	0	...		...		...	
3	400	0	...		...		...	
4	400	0	...		...		...	
5	377	0	17	0	...		7	1
6	462	96	102	96	...		42	10
7	441	91	81	91	...		34	0
8	360	0	...		...		...	

15. CAIRNWELL.

Plot.	Weight per acre.		Gain by application of Manure.		Loss by application of Manure.		Value of difference at 5d. per cwt.	
1	350	0	30	0	...		12	6
2	365	0	45	0	...		18	9
3	340	0	20	0	...		8	4
4	320	0	...		...		...	
5	335	48	...		24	64	10	3
6	402	96	42	96	...		17	10
7	421	36	61	36	...		25	6
8	360	0	...		...		...	

16. BALQUHARN.

Plot.	Weight per acre.		Gain by application of Manure.		Loss by application of Manure.		Value of difference at 5d. per cwt.	
1	691	48	...		34	32	14	3
2	851	48	125	80	...		52	4
3	774	32	48	64	...		20	2
4	725	80	...		...		...	
5	516	28	...		237	11	98	9
6	820	0	66	70	...		27	9
7	825	80	72	38	...		30	1
8	753	42	...		...		...	

17. EASTERSIDE.

Plot.	Weight per acre.		Gain by application of Manure.		Loss by application of Manure.		Value of difference at 5d. per cwt.	
1	400	0	65	80	...		27	4
2	391	48	57	16	...		23	9
3	385	80	51	48	...		21	5
4	334	32	...		...		...	
5	400	0	8	64	...		3	6
6	451	48	60	0	...		25	0
7	462	96	71	48	...		29	9
8	391	48	...		...		...	

18. DRUIDSDALE.

Plot.	Weight per acre.		Gain by application of Manure.		Loss by application of Manure.		Value of difference at 5d. per cwt.	
1	344	32	101	48	...		42	3
2	257	16	14	32	...		5	11
3	391	48	148	64	...		61	10
4	242	96	...		...		...	
5	355	80	112	96	...		47	0
6	302	96	60	0	...		25	0
7	355	80	112	96	...		47	0
8	242	96	...		...		...	

EXPERIMENT IV.—*continued.*

19. MAINS OF CATTERLINE.

Plot.	Weight per acre.	Gain by application of Manure.	Loss by application of Manure.	Value of difference at 5d. per cwt.
	cwt. lb.	cwt. lb.	cwt. lb.	s. d.
1	618 64	35 80	...	14 10
2	611 48	28 [illegible]4	...	11 10
3	554 32	...	28 64	11 10
4	582 96	...	...	...
5	...	...	...	...
6	...	...	...	...
7	...	...	...	...
8	...	...	...	...

20. CATTERLOCH.

Plot.	Weight per acre.	Gain by application of Manure.	Loss by application of Manure.	Value of difference at 5d. per cwt.
	cwt. lb.	cwt. lb.	cwt. lb.	s. d.
1	500 0	180 0	...	75 0
2	460 0	140 0	...	58 4
3	400 0	80 0	...	33 4
4	320 0	...	...	...
5	...	...	...	...
6	...	...	...	...
7	...	...	...	...
8	...	...	...	...

21. KERNOON.

Plot.	Weight per acre.	Gain by application of Manure.	Loss by application of Manure.	Value of difference at 5d. per cwt.
1	320 0	30 0	...	12 6
2	294 32	4 32	...	1 9
3	294 32	4 32	...	1 9
4	290 0	...	...	...
5	320 0	54 32	...	22 7
6	365 0	99 32	...	41 4
7	370 0	104 32	...	43 5
8	265 80	...	...	...

22. NEWTONLEYS.

Plot.	Weight per acre.	Gain by application of Manure.	Loss by application of Manure.	Value of difference at 5d. per cwt.
1	520 0	...	71 8	29 7
2	540 80	...	50 40	20 11
3	550 0	...	41 8	17 1
4	591 8	. .	...	...
5	570 40	28 104	...	12 0
6	580 40	38 104	...	16 2
7	551 8	9 72	...	4 0
8	541 48	...	...	...

23. LAW OF LUMGAIR.

Plot.	Weight per acre.	Gain by application of Manure.	Loss by application of Manure.	Value of difference at 5d. per cwt.
1	...	...	...	...
2	...	...	...	...
3	...	...	...	...
4	...	...	...	...
5	359 32	25 80	...	10 8
6	415 80	82 16	...	34 2
7	402 16	68 64	...	28 6
8	333 64	...	...	...

24. URAS.

Plot.	Weight per acre.	Gain by application of Manure.	Loss by application of Manure.	Value of difference at 5d. per cwt.
1	303 104	7 56	...	3 1
2	337 96	41 48	...	17 3
3	277 16	19 32	..	8 0
4	296 48	...	...	...
5	...	...	...	...
6	...	...	...	...
7	...	...	. .	...
8	...	...	...	...

2. WESTPORT (*turnip-tops*).

Plot.	Weight per acre.	Gain by application of Manure.	Loss by application of Manure.	Value of difference at 5d. per cwt.
				At 3d.
1	98 44	10 60	...	2 7
2	100 80	12 96	...	3 2
3	89 32	1 48	...	0 4
4	87 96	...	...	...
5	101 88	...	3 104	0 11
6	115 0	9 32	...	2 4
7	127 16	21 48	...	5 4
8	105 80	...	...	...

CHEMICAL DEPARTMENT.

REPORTS by Dr A. P. AITKEN, Chemist to the Society.

FEEDING EXPERIMENTS IN 1888-89.[1]

EXPERIMENT X.

What is the most appropriate and economical ratio of albumen to carbohydrates in the fodder supplied to cattle during the fattening period?

The feeding experiments conducted at Agricultural Institutions and Stations on the Continent for a great many years have thrown a flood of light upon the whole subject of animal nutrition, and one of the main facts they have established is, that according to the bodily condition which an animal is in, and according to the kind of work it has to do or the use it is put to, the proportion of albuminoid and non-albuminoid constituents of its food should bear a definite relation to each other. This is sometimes called the *nutrient ratio* or the *albuminoid ratio*, and normal dietaries are described for different classes of stock on the basis of this ratio.

In this country feeders have not, except in comparatively rare instances, begun to regulate their feeding practice on the basis of the nutrient ratio, but have conducted their feeding operations on purely empirical lines. As might be expected, opinions vary very widely as to the kind of diet that is most suitable for stock of various kinds. Some give twice or three times as much concentrated fodder as others, and thus the nutrient ratio employed by different feeders varies pretty widely. Many adopt a regular uniform system of feeding which does not vary from year to year, and in the case of fattening cattle it consists in giving a certain weight of turnips and straw, and a certain weight of linseed-cake or other concentrated fodder, and the relative quantity of one or more of these substances is sometimes increased from month to month, and sometimes it is not. It is evident in such cases that the nutrient ratio will differ from year to year, inasmuch as the nutrient ratios of turnips and straw are not the same in different years, but variable according to the season, the way in which the crops were manured and harvested, and other considerations; while the feeding values of purchased cakes, meals, &c., are far from constant. In some years, therefore, under a uniform system of management, cattle fatten rapidly, and in others they do not. In other cases, feeders alter their system from year to year and from month to month, according as they think the circumstances require, but without reference to any predetermined nutrient ratio.

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[1] The fodders used in all these experiments were analysed, and the results are given on p. 331. The numbers in brackets after the names of fodders in the reports refer to these analyses.

It seemed desirable as a beginning, that a preliminary experiment should be made which would show plainly whether it was of great importance to attend to the nutrient ratio, and if so, whether it was more economical to begin with fodder having a wide ratio—that is to say, a ratio in which the albumen was small in comparison with the carbohydrates and other non-albuminoid matter—and go on narrowing the ratio by giving a more albuminoid diet from month to month; or conversely, to begin with a fodder having a narrow ratio, and go on widening it from month to month; or whether it was better to adhere to a narrow ratio or to a wide ratio all the time.

This experiment was taken up by three feeders:—

Mr George Henderson, Shidlaw, Coldstream;
Mr John Milne, Mains of Laithers, Turriff;
Mr Arres-Mather, Delnies, Nairn;—

and the following was the plan on which it was conducted:—

An even lot of sixteen cattle was selected, and after a fortnight's probation, during which they were all fed alike on turnips and straw, and their progress noted, the twelve most suitable were chosen and divided into three equal lots of four each. Lot I. received daily 5 lb. of pure, specially made linseed-cake ground into meal, during the whole course of the experiment, which was to last four months. Lot II. received a meal with less albumen than that of Lot I., and each month thereafter the amount of albumen was diminished and the amount of carbohydrates proportionately increased, so that during the last month they were feeding on a meal having a wide ratio—that is to say, very poor in albumen and very rich in carbohydrates. Lot III. were fed in a converse manner to Lot II. They began with the meal on which Lot II. ended, and they ended with the meal upon which Lot II. began.

The following were the compositions of the five meals used, and the instructions issued to the experimenters along with schedules for recording the weights of the cattle and other details (see analyses 15 to 19, p. 331):—

		Ingredients per cent.	Ratio of Albumen to Carbohydrates.
Meal A	Ground linseed-cake (No. 15)	100	1 to 2
Meal B	Ground linseed-cake	65	1 to 3½
	Maize-meal (No. 26)	20	
	Locust-bean meal (No. 27)	10	
	Sugar (No. 29)	3	
	Linseed-oil	2	
Meal C	Ground linseed-cake	35	1 to 6
	Maize-meal	40	
	Locust-bean meal	15	
	Sugar	6½	
	Linseed-oil	3½	
Meal D	Ground linseed-cake	15	1 to 10
	Maize-meal	45	
	Locust-bean meal	20	
	Sugar	15	
	Linseed-oil	5	
Meal E	Ground linseed-cake	5	1 to 15
	Maize-meal	50	
	Locust-bean meal	20	
	Sugar	20	
	Linseed-oil	5	

"Meals so manufactured contain each nearly the same percentage of oil, and they must be given in equal weight during the whole course of the experiment—viz., 5 lb. per head per day.

"They may be given dry, or mixed with pulped turnips and chopped straw, or in any other way, so as to secure that each animal eats the entire 5 lb. of meal daily.

"The fodder of the cattle shall consist of a definite weight of turnips either sliced or pulped, or partly sliced and partly pulped, but in any case they must all get the same quantity per head per day, and the quantity must be what experience has shown they can eat up easily. Any further appetite must be satisfied by means of long straw, which is to be given *ad libitum.*

"If found desirable and practicable, the quantity of turnips may be increased from month to month.

"The amount of long straw eaten by each animal per month of 28 days should be carefully noted. A convenient method of giving the straw is to tie it up in bundles of 7 lb. each, and to mark the number of bundles supplied to each animal.

"Care must be taken to prevent loss of straw by allowing it to mix with the litter. If dried moss or litter other than straw is used, any fodder-straw falling among the feet of the animals may be gathered again and its quantity deducted from the fodder-straw.

"The cattle under experiment must be housed in the same house, and be all kept in similar circumstances as to stall arrangement, warmth, ventilation, water-supply, &c.

"It will be sufficient to weigh the cattle once every twenty-eight days, and these weighings will thus be made on the same day of the week, and they should be made at the same time of the day on each occasion.

"The experiment will embrace four periods of twenty-eight days each, and the feeding of the three lots of cattle shall be conducted as follows:—

Lot I.	Meal.	Lot II.	Meal.	Lot III.	Meal.
First period	A	First period .	B	First period .	E
Second "	A	Second " .	C	Second " .	D
Third "	A	Third " .	D	Third " .	C
Fourth "	A	Fourth " .	E	Fourth " .	B"

In order to secure accuracy, and to save trouble to the experimenters, the meals were all supplied in small paper bags, each bag containing one feed and marked with its proper letter. These were prepared with great care by Mr Milne, Dyce, and sent securely packed in casks to the different farms.

We may take first Mr Henderson's experiment, and as he has sent in a very full report of it, it had better be given in his own words.

Report of Mr George Henderson, Shidlaw.

"To carry out Experiment X. of the Highland and Agricultural Society's chemical department, I selected sixteen shorthorn cattle which had been grazed together during the summer of 1888.

"On 5th November 1888, they were placed in pairs in feeding-boxes under the same roof, having the same stall-room, warmth, and ventilation, giving them an equal quantity of sliced green-top white turnips (10 stones each), $2\frac{1}{2}$ lb. decorticated cotton-cake, and oat-straw *ad libitum*. On 12th November the weights of the sixteen cattle were as follows:—

	Lot I.				*Lot III.*		
No.	cwt.	qr.	lb.	No.	cwt.	qr.	lb.
1	8	0	15	9	8	3	22
2	8	0	22	10	7	3	2
3	9	0	1	11	9	1	19
4	8	2	6	12	7	3	15
	Lot II.				*Lot IV.*		
5	9	2	1	13	9	0	11
6	8	1	18	14	7	3	27
7	7	3	5	15	7	2	27
8	8	2	1	16	7	1	11

"From that date the oat-straw as well as the turnips were weighed. On 10th December, after being kept for twenty-eight days on 10 stones per head of sliced green-top white turnips (No. 3), 9 lb. of oat-straw (No. 9), and 2½ lb. decorticated cotton-cake, their weights were as shown in the accompanying schedule (see Table I. beginning of first period). During this probationary month the cattle were to all appearance thriving equally, though the weighings of some of them showed material differences. One gained 7 stone 10 lb., and another 6 stone 11 lb., for their month's keep, while two gained only 1 stone 3 lb. and 2 stone respectively. To give satisfactory reasons for this excessive gain of the two over the other two would be difficult. The one that gained most and the one that gained least were stalled together, and the strange thing is, that the one that gained least was king over his neighbour, and would be sure to have his full share of what was going. The beast that gained 6 stone 11 lb. was the leanest of the lot when they were put in.

"The gains of the sixteen cattle in singles and pairs were as follows:—

	Lot I.					*Lot III.*			
No.	st.	lb.	st.	lb.	No.	st.	lb.	st.	lb.
1	4	13	10	4	9	4	12	9	3
2	5	5			10	4	5		
3	7	10	8	13	11	4	6	10	4
4	1	3			12	5	12		
	Lot II.					*Lot IV.*			
5	5	8	8	5	13	2	2	5	7
6	2	11			14	3	5		
7	2	0	6	10	15	3	0	9	11
8	4	10			16	6	11		

"The cattle were now (10th December) put upon the experimental feeding-meals, 5 lb. per head per day. It was intended at first to confine the experiment to three lots of four cattle each, but it was thought that another lot getting a meal with a wide ratio (meal D) would make the experiment more complete, so that Lot IV. was retained for that purpose. As meal D could not be got forward in time, I gave Lot IV. 5 lb. of Ovens' feeding-cake (No. 28) the first month. During this month the cattle got 9 lb. straw as before, but the turnips were changed to Fosterton Hybrid, 10 stones per head.

"After twenty-eight days, during which Lot I. got meal A, Lot II. meal B, Lot III. meal E, and Lot IV. Ovens' cake, they were weighed on 7th January 1889, with the following results. (See Table I., at end of first period.)

TABLE I.—Experiment X.

	Lot I. close ratio.				Lot II. widening ratio.				Lot III. narrowing ratio.				Lot IV. wide ratio.			
	No.	Weight of Animal.			No.	Weight of Animal.			No.	Weight of Animal.			No.	Weight of Animal.		
		cwt.	qr.	lb.		cwt.	qr.	lb.		cwt.	qr.	lb.		cwt.	qr.	lb.
At beginning of first period, 10th Dec. 1888	1	8	3	0	5	10	0	23	9	9	2	6	13	9	1	13
	2	8	3	13	6	8	3	1	10	8	1	7	14	8	1	18
	3	9	3	25	7	8	0	5	11	9	3	25	15	8	0	13
	4	8	3	23	8	9	0	11	12	8	2	13	16	8	0	22
Total . .		36	1	5		36	0	12		36	1	23		34	0	10
		Cake A.				Cake B.				Cake E.				Ovens' Feeding Cake.		
At end of first period, 7th January 1889	1	9	1	27	5	10	2	0	9	10	0	0	13	9	3	9
	2	9	1	19	6	9	1	0	10	8	2	9	14	9	0	0
	3	10	0	15	7	8	1	25	11	10	1	10	15	8	2	9
	4	9	1	16	8	9	2	0	12	8	3	15	16	8	3	22
Total . .		38	1	11		37	2	25		37	3	6		36	1	12
		Cake A.				Cake C.				Cake D.				Cake D.		
At end of second period, 4th Feb.	1	9	3	7	5	10	3	20	9	10	3	19	13	10	1	14
	2	10	0	0	6	9	3	4	10	9	1	22	14	9	1	16
	3	10	3	19	7	9	0	17	11	11	0	19	15	9	0	17
	4	9	2	26	8	10	1	12	12	9	1	17	16	9	1	14
Total . .		40	1	24		40	0	25		40	3	21		38	1	5
		Cake A.				Cake D.				Cake C.				Cake D.		
At end of third period, 4th March	1	10	2	14	5	11	1	2	9	11	3	16	13	10	3	17
	2	10	3	10	6	10	1	6	10	9	3	2	14	9	3	7
	3	11	1	26	7	9	1	23	11	11	2	25	15	9	2	23
	4	10	1	0	8	11	0	3	12	10	0	2	16	9	3	14
Total . .		43	0	22		42	0	6		43	1	17		40	1	5
		Cake A.				Cake E.				Cake B.				Cake D.		
At end of fourth period, 1st April	1	11	1	4	5	11	2	19	9	12	1	9	13	11	0	13
	2	11	2	4	6	10	3	19	10	10	1	10	14	10	1	18
	3	12	1	21	7	10	1	14	11	12	1	13	15	10	1	14
	4	10	3	19	8	11	2	4	12	10	2	12	16	10	1	4
Total . .		46	0	20		44	2	0		45	2	16		42	0	17

And the gains individually and in pairs were—

	Lot I.					*Lot III.*			
No.	st.	lb.	st.	lb.	No.	st.	lb.	st.	lb.
1	5	13	9	9	9	3	8	5	10
2	3	10			10	2	2		
3	1	4	6	11	11	2	13	5	1
4	5	7			12	2	2		
	Lot II.					*Lot IV.*			
5	2	5	6	4	13	3	10	8	6
6	3	13			14	4	10		
7	3	6	6	9	15	3	1	9	1
8	3	3			16	6	0		

"Here again we meet with strange vagaries in the gains of individual cattle. No. 3 beast, which gained most the preceding month, has gained least this month; while his mate, which gained only 1 stone 3 lb. the former month, has now gained in twenty-eight days 5 stone 7 lb. Various reasons might be suggested to account for these irregularities, but in comparing the average gains of the four lots, the approximate value of the different meals for feeding purposes should be established, which was the aim of the experiment. These gains were—

	st.	lb.	
Meal A	4	1½	gross weight.
" B	3	3¼	"
" E	2	9¾	"
" (Ovens')	4	5¼	"

"On 7th January the cattle were put on the following fare: Lot I., meal A as before; Lot II., meal C; Lot III., meal D; and Lot IV., also meal D. Along with these they got 10 stones each Aberdeen yellow turnips, and 9 lb. oat-straw as before. All seemed to thrive equally well, eating up their meals rapidly, especially those feeding on the sugary meal D, as they had done the month before with the still more sugary meal E. Those on meal A took more readily to their turnips, and would have taken more if they had got them. They delayed a good while over their meal, but always finished it before morning. The next weighing was on 4th February (see Table I., end of second period), and the gain of weight individually and in pairs was—

	Lot I.					*Lot II.*			
No.	st.	lb.	st.	lb.	No.	st.	lb.	st.	lb.
1	2	8	7	13	5	3	6	7	10
2	5	5			6	4	4		
3	6	4	9	0	7	5	6	12	4
4	2	10			8	6	12		

Lot III.					*Lot IV.*				
No.	st.	lb.	st.	lb.	No.	st.	lb.	st.	lb.
9	7	5	14	4	13	4	5	7	7
10	6	13			14	3	2		
11	6	9	10	11	15	4	8	7	0
12	4	2			16	2	6		

"Again it is seen that the rate of progress, as determined by increase in weight, shows great differences, although to all appearance the beasts were all doing equally well. When the lots are taken together the average increase was per head—

Lot.		st.	lb.	
I.	Meal A	4	3¼	gross weight.
II.	" C	5	0	"
III.	" D	6	3¾	"
IV.	" D	3	8¾	"

This shows either that it is possible by the scales to discover differences of progress that cannot be distinguished by mere observation, or that cattle are liable to fluctuate in weight from period to period from causes independent of their thriving.

"The cattle were again weighed on 4th March (see Table I., end of third period), and their increase individually and in pairs was—

Lot I.					*Lot III.*				
No.	st.	lb.	st.	lb.	No.	st.	lb.	st.	lb.
1	6	7	13	3	9	7	11	10	5
2	6	10			10	2	8		
3	4	7	8	9	11	4	6	9	5
4	4	2			12	4	13		
Lot II.					*Lot IV.*				
5	2	10	6	12	13	3	12	7	3
6	4	2			14	3	5		
7	2	6	7	11	15	4	6	8	6
8	5	5			16	4	0		

"As before, there are some curious differences noticeable. Beasts 9 and 10, which before had been pretty even in their monthly weighings, show this month a difference of fully 5 stones, whereas the others of Lots I., III., and IV. are very regular.

"The gains of the different lots were on an average—

Lot.		st.	lb.
I.	Meal A	5	6½
II.	" D	3	9¼
III.	" C	4	13
IV.	" D	3	12¾

"During the next period, 4th February to 1st April, the cattle received per head 10 stone 6 lb. swedes, and 6 lb. per head oat-straw, in addition to their meals, and weighed as shown in Table I., showing the following increase per head and per pair—

	Lot I.					*Lot III.*			
No.	st.	lb.	st.	lb.	No.	st.	lb.	st.	lb.
1	5	4	10	2	9	2	11	7	5
2	4	12			10	4	8		
3	7	9	13	0	11	5	2	9	12
4	5	5			12	4	10		
	Lot II.					*Lot IV.*			
5	3	3	8	2	13	2	1	6	12
6	4	13			14	4	11		
7	7	5	11	6	15	5	5	8	9
8	4	1			16	3	4		

And the average gain per head of each lot is therefore—

Lot.		st.	lb.
I.	Meal A	5	11
II.	" E	4	12½
III.	" B	4	4¼
IV.	" D	3	12¼

This concludes the four periods proposed in the experiment, and the results may be thus summarised—

Lot.			st.	lb.
I.	Getting meal A,	gained	78	5
II.	" meals B, C, D, E,	"	67	2
III.	" meals E, D, C, B,	"	72	11
IV.	" meal D,	"	63	2

The conclusion to be drawn from the total gains of the four lots of cattle would be—1st, It is most profitable to use a concentrated fodder having a ratio of 1 : 2. 2d, Cattle progress better by commencing with a feeding stuff poor in albumen, but becoming richer and richer in that constituent from month to month, than they do by commencing with a stuff rich in albumen, and proceeding to one poorer and poorer in it from month to month. 3d, A feeding stuff with a wide ratio like meal D is not so good as one with a narrow ratio like linseed-cake.

" As I thought the cattle not prime enough at the end of the fourth period, I kept them for another period of twenty-eight days, and fed them as follows:—

Lot.
I. 6 lb. linseed-cake.
II. 3 lb. linseed-cake, and 3 lb. cotton-cake.
III. } 2 lb. ground Indian corn, 2 lb. ground barley,
IV. } and 2 lb. ground oats.

" One half of the cattle were thus fed on cake, and one half on corn.

"Their weights on 29th April were—

	Lot I.				*Lot III.*		
No.	cwt.	qr.	lb.	No.	cwt.	qr.	lb.
1	11	3	18	9	12	2	20
2	12	0	13	10	10	3	0
3	12	3	18	11	12	3	11
4	11	2	4	12	11	1	4
	Lot II.				*Lot IV.*		
5	12	1	12	13	11	1	20
6	11	0	24	14	10	2	21
7	10	1	25	16	10	3	4
8	11	2	14	15	10	3	11

And its average gain per head were—

Lot.		st.	lb.
I.	Linseed-cake	4	8¼
II.	Linseed and cotton cake	2	4¾
III. IV.	Ground corn	3	6¾

"I do not think the above average gains require any remark, the period of twenty-eight days being too short to prove anything; still, it is interesting to see that ground corn, which was the cheapest food, held its own with the cake.

"It may be of some interest to note that the average dead-weight of the sixteen cattle on 12th November 1888, calculating 7 lb. to the stone, was 33 stones, and that they cost £12, 7s. 6d. each, being 7s. 9½d. per stone. On 29th April 1889, the average dead-weight of the same cattle, calculating 8 lb. to the stone, was 52½ stones, and they brought £20, 17s. 6d. each, being 7s. 11½d. per stone. During the whole period, from 12th November 1888 to 29th April 1889, each beast consumed 57 stones of artificial food, costing £3, 2s. 8½d., 1716 stones of white, yellow, and swede turnips, and 90 stones of oat-straw."

This carefully performed experiment not only supplies much information on the problems it was intended to solve, but it brings prominently into notice some points of great importance to the success of feeding experiments that were not anticipated when this and the other experiments began. These will be best seen from an examination of Table II., showing the monthly increase of the individual cattle in Mr Henderson's experiments. It would seem from these figures that the monthly increase varied up and down in an extraordinary manner, in the case of almost every animal. It is worth while to examine the record of a few of them. Bullock No. 1 made the best progress of its lot in December, and the worst in January, but seemed to regain lost ground the following month. Bullock No. 3 was by far the worst in December, but it was the best of the four in January; it fell behind again in February, and then made

TABLE II.—EXPERIMENT X. SHIDLAW. MONTHLY INCREASE OF WEIGHT PER BULLOCK.

Lot.	No.	Dec.	Jan.	Feb.	Mar.	Totals.
		lb.	lb.	lb.	lb.	lb.
I. Meal A, narrow ratio	1	83	36	91	78	288
	2	52	75	94	68	289
	3	18	88	63	107	276
	4	77	38	58	75	248
Total . . .		230	237	306	328	1101
II. Meals B to E, narrow to wide ratio	5	33	48	38	45	164
	6	55	60	58	69	242
	7	48	76	34	103	261
	8	45	96	75	57	273
Total . . .		181	280	205	274	940
III. Meals E to B, wide to narrow ratio	9	50	103	109	39	301
	10	30	97	36	64	227
	11	41	93	62	72	268
	12	30	58	69	66	223
Total . . .		151	351	276	241	1019
IV. Meal D, wide ratio	13	52	61	54	29	196
	14	66	44	47	67	224
	15	43	64	60	75	242
	16	84	34	56	46	220
Total . . .		245	203	217	217	882
Grand totals per month		807	1071	1004	1060	...

an extraordinary advance in March. In Lot II., bullock No. 7 shows a somewhat similar record, and so does bullock No. 10 of Lot III. The progress of these three animals, and others that might be singled out, shows an alternate rise and fall in successive months which requires explanation. Either the animals throve by fits and starts, or their monthly weighings are no certain indication of their progress. Mr Henderson reports that there was no great difference in the thriving of the animals, so far as the eye could detect, and when the total gain during the four months is looked at, there was no very great difference in the progress of those animals which showed the greatest fluctuations in their monthly record. It seems evident, therefore, that monthly weighings are not to be trusted as an indication of progress, and that something occurs in the monthly, or perhaps in the daily, condition of an animal that affects its live-weight, but which may be found to have no reference to its feeding progress or to its weight of carcass. Considering the enormous weight of undigested fodder and of indigestible food-residues which a bullock contains in its stomach and bowels, it is to the temporary variations in the amount of the contents of the whole alimentary tract that we must first look for an explanation of the discrepancies in the monthly weighings.

There are two ways in which to obtain evidence on this point: either to weigh a number of cattle daily, and note whether great fluctuations occur in their daily weights which could be accounted for only on the ground of irregularity in the daily amounts of their evacuations—or to determine the actual amount of these evacuations directly. Mr John Milne was kind enough to undertake to supply statistics by the former method, and Mr John Hart to do so by the latter. Mr Milne selected eight cattle, and weighed them daily for a whole month, and the record is given in Table III.

All these cattle were accustomed to be handled, and their daily weights were taken without the least disturbance to their progress. The gains or losses on consecutive days are shown on Table IV. (p. 302).

It is seen from this interesting record that it is not an uncommon thing for cattle to vary about 20 lb. in weight, up or down, from one day to another, and that they frequently lose weight for three consecutive days and regain it during the next three, and that weighings on even three successive days might not suffice to give a reliable indication of the live-weight. If such differences occur in the daily weight of cattle accustomed to be handled, it is probable that even greater differences would be observed in the case of cattle weighed once a-month under conditions of considerable excitement.

TABLE III.—DAILY WEIGHT OF SIX-QUARTER-OLD STEERS ON FARM OF MAINS OF LAITHERS, TURRIFF, WEIGHED REGULARLY AT 10 A.M.

Jan. 1890.	Roan 9.	White 8.	Curly 7.	Red and White 12.	Red and White 6.	Red X.	Red and White 5.	Red 1.
	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt qr. lb
2	9 3 19	8 2 0	9 1 21	9 1 7	10 1 17	9 2 5	9 2 6	9 0 9
3	9 3 20	8 2 13	9 1 20	9 1 19	10 2 2	9 2 17	9 2 17	9 0 19
4	9 3 9	8 2 26	9 2 7	9 2 16	10 2 10	9 3 3	9 2 20	9 1 3
5	9 2 22	8 3 12	9 2 0	9 2 17	10 2 5	9 2 14	9 2 25	9 1 5
6	9 2 18	8 2 13	9 2 0	9 2 19	10 1 15	9 2 0	9 2 4	9 1 0
7	9 2 17	8 2 9	9 2 0	9 2 7	10 1 15	9 2 5	9 2 17	9 1 0
8	9 2 26	8 2 21	9 2 0	9 2 5	10 2 3	9 2 14	9 2 16	9 1 0
9	9 3 22	8 3 0	9 1 18	9 2 2	10 1 21	9 2 17	9 2 18	9 0 26
10	10 0 7	8 3 14	9 2 12	9 2 10	10 2 5	9 2 18	9 2 26	9 1 0
11	10 0 4	8 3 8	9 2 10	9 2 11	10 2 11	9 2 14	9 3 16	9 1 7
13	10 0 4	8 3 0	9 2 14	9 2 7	10 2 0	9 2 12	9 3 7	9 1 9
14	10 0 16	8 3 10	9 2 7	9 2 14	10 2 11	9 2 16	9 3 11	9 1 15
15	10 0 21	8 3 11	9 2 9	9 2 23	10 2 23	9 2 24	9 3 9	9 1 17
16	10 1 0	8 3 11	9 2 15	9 3 0	10 2 21	9 3 15	9 3 21	9 1 24
17	10 0 24	8 3 18	9 2 18	9 2 12	10 2 21	9 2 26	9 3 21	9 1 26
18	10 1 13	9 0 0	9 2 23	9 2 19	10 2 19	9 3 7	9 3 26	9 2 9
20	10 0 25	8 3 19	9 2 18	9 2 24	10 2 21	9 3 5	9 3 21	9 1 24
21	10 0 25	8 3 21	9 2 21	9 2 17	10 2 25	9 3 3	9 3 19	9 1 23
22	10 0 25	9 0 5	9 2 26	9 2 17	10 3 7	9 3 14	9 3 23	9 2 0
23	10 1 16	9 0 0	9 3 5	9 3 5	10 3 9	9 3 21	9 3 26	9 2 9
24	10 1 19	9 0 15	9 3 15	9 3 13	10 3 21	9 3 26	10 0 12	9 2 24
25	10 1 22	9 0 13	9 3 15	9 3 0	11 0 0	10 0 0	10 0 7	9 2 24
27	10 1 21	9 0 11	9 3 25	9 3 7	10 3 21	9 3 26	10 0 14	9 2 26
28	10 1 24	9 0 18	9 3 21	9 3 11	10 3 21	10 0 6	10 0 11	9 2 21
29	10 2 6	9 0 18	10 0 3	9 3 20	11 0 3	10 0 3	10 0 17	9 3 3
30	10 2 8	9 1 0	10 0 7	9 3 26	11 0 16	10 0 11	10 0 23	9 3 16

I have also been supplied by Mr David Wilson, yr. of Carbeth, with the weight of eight steers, taken on three consecutive days, at the experimental station of Wisconsin (Report for 1888), as illustrating the expediency of taking the average of the three weighings in endeavouring to arrive at the real live-weight of such animals (see p. 303).

The averages of the three weighings seldom differ from that of the middle one by more than 10 lb. There is, however, one notable exception—viz., steer No. 3, between the second and third weighings of which there occurred in December a difference of 72 lb. Some discussion has recently taken place on

TABLE IV.—Daily Fluctuations in Weight of Six-quarter-old Steers. Mr Milne, Mains of Laithers.

Date.	Roan 9.		White 3.		Curly 7.		Red and White 12.		Red and White 6.		Red 4.		Red and White 5.		Red 1.	
Jan.	Gain.	Loss.	Gain.	Loss.	Gain.	Loss.	Gain.	Loss.	Gain.	Loss.	Gain.	Loss.	Gain.	Loss.	Gain.	Loss.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
3	1	..	13	..	..	1	12	..	13	..	12	..	11	..	10	..
4	..	11	13	..	15	..	25	..	8	..	14	..	3	..	12	..
5	..	15	14	..	..	7	1	..	..	5	..	17	5	..	2	..
6	..	4	..	27	..	..	2	..	..	18	..	14	..	21	..	5
7	..	1	..	4	..	..	..	12	..	..	5	..	13	..	..	..
8	9	..	12	..	..	..	..	2	16	..	9	..	..	1	..	..
9	24	.	7	..	..	10	..	3	..	10	3	..	2	..	..	2
10	13	..	14	..	22	..	8	..	12	..	1	..	8	..	2	..
11	..	3	..	6	..	2	4	..	6	..	..	4	18	..	7	..
13	..	..	..	8	4	..	..	7	..	11	..	2	..	9	2	..
14	12	..	10	..	..	7	7	..	11	..	4	..	4	..	6	..
15	5	..	1	..	2	..	9	..	12	..	8	..	..	2	2	..
16	7	..	..	..	6	..	5	..	..	2	19	..	12	..	7	..
17	..	4	7	..	3	..	..	16	..	..	..	17	..	..	2	..
18	17	..	10	..	5	..	7	..	..	2	9	..	5	..	11	..
20	..	16	..	9	..	5	5	..	2	..	..	2	..	5	..	13
21	..	..	2	..	3	..	..	7	4	..	..	2	..	2	..	1
22	..	..	12	..	5	..	..	..	10	..	11	..	4	..	5	..
23	19	..	..	5	7	..	16	..	2	..	7	..	3	..	9	..
24	3	..	15	..	10	..	8	..	12	..	5	..	14	..	15	..
25	3	..	..	2	..	..	..	13	7	..	2	..	..	5	..	..
27	..	1	..	2	10	..	7	..	..	7	..	2	7	..	2	..
28	3	..	7	..	..	4	4	..	..	..	8	..	..	3	..	5
29	10	..	..	..	10	..	9	..	10	..	..	3	6	..	10	..
30	2	..	10	..	4	..	6	..	13	..	8	..	6	..	13	..
Total	78	..	84	..	70	..	75	..	83	..	62	..	73	..	91	..

the comparative merits of selling cattle by live-weight, or by appearance aided by handling. These statistics show that as regards an individual animal the weight at any one weighing may be several stones above or below the real live-weight, and that it is only where six or more animals are weighed together that the scales can be trusted to give accurate results.

DAILY WEIGHT OF STEERS, WISCONSIN EXPERIMENTAL STATION.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.
December 1	1292	1105	1250	1315	1281	1210	1125	1084
" 2	1303	1082	1217	1298	1253	1191	1125	1093
" 3	1291	1095	1289	1286	1249	1202	1113	1102
Average .	1295	1094	1252	1300	1261	1201	1121	1093
January 5	1400	1162	1290	1356	1380	1340	1260	1265
" 6	1385	1150	1270	1335	1360	1342	1250	1242
" 7	1371	1160	1280	1330	1365	1355	1225	1249
Average .	1385	1157	1280	1341	1368	1346	1245	1252

Mr Hart caused a collection to be made of the solid excreta of five different cattle from 6 A.M. till 6 P.M., and found them to be as follows:—

WEIGHT OF SOLID EXCRETA IN TWELVE HOURS.

No.	lb.	oz.
1	20	13½
2	17	8
3	9	0
4	29	8
5	15	8

It is thus seen that the amount of solid excrement passed by cattle in twelve hours varies very much; and this observation goes far to explain the unexpected differences in the monthly weights of Mr Henderson's cattle, and also in those of other experimenters whose reports will follow.

It is quite evident that, in future feeding experiments, it will be necessary to weigh cattle during the last three days of each period of experiment, so as to get a more satisfactory estimate of their true live-weight. There is, of course, another way of attaining the same end—viz., that of increasing the number of cattle under experiment to such an extent as to be sure of getting fairly average results. In the case of the experiment before us, each lot consisted of four cattle, so that the amount of probable error is greatly reduced, and the united record of the four cattle in each lot may be considered fairly reliable. It is advisable, however, that in future experiments each lot should consist of at least six cattle, so that any member of the lot whose record is very different from the others may be unhesitatingly removed from the experiment. Where there are only four cattle in a lot, one has some hesitation in discarding the record of any animal, unless it differs very much from that of its neighbours in the lot.

Among Mr Henderson's cattle there are two animals whose record may be considered abnormal—viz., No. 5, which is seen, from the results in Table II., to be nearly 100 lb. behind the other three in its increase. There was nothing wrong with the animal, except that it was less growthy than the others. It is a difficult matter to decide whether or not its record should be ignored, and the feeding value of the fodder determined by results obtained by the other three. Again, in Lot III., bullock No. 9 has made far more progress than any of the other three; and it becomes a question whether its record should not also be ignored, and the average of the other three taken instead. That animal increased in live-weight 103 lb. in January and 109 lb. in February. This extraordinary increase is balanced to some extent by the very slight increase made in March; but if the average of the three cattle of each lot whose progress was most equal is to be taken in determining the feeding value of the fodder, the total increase in live-weight produced by the fodder of Lot III. will not be so great as in the case of the three most equal cattle of Lot II. It may be well to compare the average increase per head of the four cattle in each lot with that of the three in each lot whose progress was most equal.

Lot.	Ratio.	Average of four. lb.	Average of three. lb.
I.	Narrow	275	284
II.	From narrow to wide . .	235	258
III.	From wide to narrow . .	255	239
IV.	Wide	228	220

As regards the answer to the questions proposed in the experiment, it is pretty evident that cattle fed on a bye-fodder with a narrow ratio do better than those fed on one with a wide ratio; but whether it is better to go from one with a narrow ratio to one with a wide ratio is doubtful. The one fact brought out is, that the more albumen the animals have consumed the greater has been their progress.

On the last line of the table is shown the increase of the whole sixteen cattle during each month. During the first month the progress was slow chiefly in Lots II. and III., thereafter the increase was very steady.

MR JOHN MILNE, INVERURIE.

We may now examine the results obtained by Mr Milne on his farm at Mains of Laithers. The same system of feeding was adopted in this as in the previous case, with the exception that the turnips were pulped and given along with chaff or cut straw. During the first two periods the bullocks got yellow turnips (No. 4), 50 lb. per head per day. During the third period they got 60 lb. of swedes (No. 5), and during a fifth period in April they got 75 lb. of swedes. The meals were given in equal quantities thrice daily well mixed with the other fodder.

The results of the monthly weighings are shown in Table V. (p. 306).

The cattle used in this experiment were an even lot of cross Irish two-year-old steers. They were kept in a large well-constructed house, in which a large number of cattle were fed. As regards warmth, ventilation, careful grooming, and comfort generally, they were under the most favourable conditions, and the whole details of the experiment were carried out with the utmost accuracy. The monthly increase of each bullock and lot of bullocks is shown in Table VI. (p. 307).

The first thing which strikes one in glancing over these results is the small progress made during the first month by all three lots, and especially by Lot III., in which one animal actually lost 30 lb. Mr Milne explains that this poor result is easily accounted for by the fact that previous to being set apart for experiment, the cattle were fed on a food mixed with pulped turnips, and containing a quantity of aromatic spices, so that they did not take kindly to the change on to a less appetising diet; and although they consumed their fodder, it was evidently not so nutritious as that which they had been accustomed to. In the case of Lot III., the large amount of sugar contained in their meal did not agree with them, and they suffered at first from indigestion. Nevertheless, one of the bullocks in this lot throve from the first, and ended with the heaviest increase of all.

The same thing occurred with a similar lot of cattle used for Experiment XI., which will be referred to hereafter. Owing to these circumstances, the experiment cannot be said to have got properly begun till the second month, and even then the

TABLE V.—Experiment X. Mains of Laithers.

	Lot I.		Lot II.		Lot III.	
	No.	Weight of Animal.	No.	Weight of Animal.	No.	Weight of Animal.
		cwt. qr. lb.		cwt. qr. lb.		cwt. qr. lb.
At beginning of first period, 29th Nov. 1888	1	9 2 27	5	8 0 16	9	8 3 12
	2	9 2 12	6	8 3 23	10	8 3 24
	3	7 3 20	7	9 2 20	11	8 1 26
	4	8 0 21	8	8 3 9	12	9 0 15
Total . . .		35 1 14		35 2 12		35 1 21
		Meal A.		Meal B.		Meal E.
At end of first period, 27th Dec.	1	9 2 16	5	8 3 2	9	8 3 18
	2	9 3 13	6	9 0 3	10	8 3 8
	3	8 0 21	7	9 3 8	11	8 3 8
	4	8 2 14	8	9 0 7	12	9 0 17
Total . . .		36 1 8		36 2 20		35 2 23
Straw per head per day .		14.35		14.14		14.83
		Meal A.		Meal C.		Meal D.
At end of second period, 24th Jan. 1889	1	10 0 16	5	9 1 11	9	9 0 21
	2	10 1 13	6	9 2 12	10	9 0 16
	3	8 1 21	7	10 2 21	11	9 1 11
	4	8 3 15	8	9 1 19	12	9 2 17
Total . .		37 3 9		39 0 7		37 1 9
Straw per head per day .		13.52		13.31		13.67
		Meal A.		Meal D.		Meal C.
At end of third period, 21st Feb.	1	10 2 21	5	9 2 8	9	9 2 19
	2	10 3 10	6	9 3 21	10	9 3 6
	3	8 2 26	7	10 2 18	11	10 1 0
	4	9 1 9	8	9 3 12	12	10 1 7
Total . . .		39 2 10		40 0 3		40 0 4
Straw per head per day .		11.98		11.35		12.24
		Meal A.		Meal E.		Meal B.
At end of fourth period, 21st March	1	11 0 24	5	10 0 19	9	10 1 15
	2	11 2 17	6	10 2 7	10	10 2 9
	3	9 0 10	7	11 2 21	11	10 3 0
	4	9 3 17	8	10 1 13	12	10 3 16
Total . . .		41 3 12		42 3 4		42 2 12
Straw per head per day .		12.18		10.00		11.87
		Meal A.		Meal E.		Meal B.
At end of fifth period, 18th April	1	11 2 16	5	10 1 9	9	10 3 4
	2	12 0 14	6	10 2 14	10	10 3 10
	3	9 3 10	7	11 3 5	11	11 0 22
	4	10 1 23	8	10 1 25	12	11 0 17
Total . . .		44 0 7		43 0 25		43 3 25
Straw per head per day .		12.74		10.64		12.73

progress was rather slow. This is partly to be accounted for by the fact that the cattle were in fairly good condition when they began.

Among these cattle, as among Mr Henderson's, there are great differences in the progress of individual animals from month to month—one bullock, No. 7, showing a gain of 97 lb. in January, a loss of 3 lb. in February, and a gain of 115 lb. in March.

TABLE VI.—EXPERIMENT X. MAINS OF LAITHERS. MONTHLY INCREASE OF WEIGHT PER BULLOCK.

Lot.	No.	Dec.	Jan.	Feb.	March.	Total.	April.	Total.
		lb.	lb.	lb.	lb.	lb.	lb.	lb.
I. Meal A, narrow ratio	1	—1	56	61	59	175	48	223
	2	29	56	53	91	229	53	282
	3	29	28	33	40	130	84	214
	4	49	29	50	64	164	62	254
Total . .		106	169	197	254	698	247	973
II. Meals B to E, narrow to wide ratio	5	70	65	25	67	227	18	235
	6	8	65	37	70	180	7	187
	7	16	97	—3	115	225	12	237
	8	26	40	49	57	172	12	184
Total . .		120	267	108	309	804	49	853
III. Meals E to B, wide to narrow ratio	9	6	31	54	80	171	45	216
	10	—16	86	74	87	181	29	210
	11	38	59	101	56	254	50	304
	12	2	56	74	65	197	29	226
Total . .		30	182	303	288	803	153	946
Grand total		256	618	608	851		449	

During the four months Lots II. and III. made greatest progress; the former seemed to become accustomed to the gradual increase of sugar in their diet, and the latter improved as the amount of sugar, which disturbed them at first, was gradually lessened. As cattle were not fetching a good price at the end of March, Mr Milne resolved to keep them during April on the same diet as they were getting in March. The result of the additional month was very remarkable. Lot I., consuming the linseed-cake meal, went on making undisturbed progress; while Lot II., which were eating meal E, with a wide nutrient ratio, and containing much sugar, scarcely made any progress—so that they lost the lead they had, and were surpassed by the other two lots. It is evident that these cattle cannot thrive for any length of time on a diet containing so large an amount of soluble carbohydrates.

It was fortunate that Mr Milne continued the experiment another month, for otherwise his results and those of Mr Henderson's would have been in conflict, as is seen on comparing the average weights at the end of the fourth and fifth months.

Lot.	End of four months. lb.	End of five months. lb.
I.	174	243
II.	201	213
III.	201	236

The grand totals of monthly weighings, as shown in the last line of the table, show that the latter half of February and the former half of March were the best feeding months, while a great falling off took place in April, due in this instance mainly to the arrestment of the growth of Lot II.

MR JOHN ARRES-MATHER, DELNIES.

We now come to Mr Arres-Mather's experiment with a lot of sixteen well-bred English shorthorns. These received all the time 84 lb. of turnips (No. 6) per head per day, and straw *ad libitum*. The straw eaten by the various lots was not weighed.

Mr Arres-Mather reports that the cattle made poor progress all through the experiment. Some other cattle did better, but the general complaint all over the district that season was that cattle were not thriving well. It is most probable that that was due to the very inferior quality of the oat-straw produced on the light lands of Nairn and the Moray coast that season. (See analysis 13.)

The results are given in Table VII.

As in Mr Henderson's experiment, a fourth lot of cattle were selected and put on Meal D during the whole time of the experiment. Bullock No. 10 had the misfortune to have its

TABLE VII.—Experiment X. Delnies.

	Lot I.				Lot II.				Lot III.				Lot IV.			
	No.	Weight of Animal.			No.	Weight of Animal.			No.	Weight of Animal.			No.	Weight of Animal.		
		cwt.	qr.	lb.		cwt.	qr.	lb.		cwt.	qr.	lb.		cwt.	qr.	lb.
At beginning of first period, 24th Dec. 1888	1	9	2	4	5	7	3	0	9	8	0	17	13	9	2	18
	2	8	2	22	6	9	0	0	10	8	1	16	14	9	0	13
	3	9	1	10	7	8	3	20	11	9	0	24	15	8	2	12
	4	8	3	4	8	9	0	22	12	9	2	15	16	8	1	2
Total . .		36	1	12		34	3	14		35	1	16		35	3	17
		Meal A.				Meal B.				Meal E.				Meal D.		
At end of first period, 21st Jan.	1	10	0	12	5	8	1	14	9	8	1	26	13	9	3	20
	2	9	0	20	6	9	2	0	*10	8	2	22	14	9	0	24
	3	9	2	20	7	9	1	18	11	9	2	6	15	8	2	16
	4	9	1	5	8	9	2	0	12	9	2	24	16	8	2	20
Total . .		38	1	1		36	3	4		36	1	22		36	1	24
		Meal A.				Meal C.				Meal D.				Meal D.		
At end of second period, 18th Feb.	1	10	1	0	5	8	0	3	9	8	3	7	13	10	1	12
	2	9	1	12	6	10	0	0	10	8	2	18	14	9	3	10
	3	10	0	18	7	9	3	10	11	9	3	20	15	9	0	14
	4	9	3	0	8	9	3	14	12	9	3	18	16	9	0	22
Total . .		39	2	2		37	2	27		37	1	7		38	2	2
		Meal A.				Meal D.				Meal C.				Meal D.		
At end of third period, 18th March	1	10	2	24	5	8	3	21	9	9	1	26	13	10	3	18
	2	9	1	24	6	10	1	14	10	9	0	7	14	10	0	10
	3	10	1	19	7	10	0	22	11	10	1	0	15	9	1	18
	4	10	1	18	8	10	0	23	12	10	2	0	16	9	2	24
Total . .		41	0	1		40	2	24		39	1	5		40	0	14
		Meal A.				Meal E.				Meal B.				Meal D.		
At end of fourth period, 15th April	1	11	0	14	5	9	1	12	9	10	0	10	13	11	0	18
	2	10	1	10	6	10	2	20	10	9	1	18	14	10	1	20
	3	11	0	14	7	10	1	24	11	10	3	7	15	9	3	20
	4	10	3	22	8	10	2	26	12	11	0	0	16	10	0	14
Total . .		43	2	4		41	0	26		41	1	17		41	2	16

Horn knocked off on taking to be weighed.

horn knocked off on 21st January, and this put him back very much in his feeding. Allowance will require to be made for this, and it is most convenient to credit this bullock with the average increase of the other three in the lot, so that the results on the whole may be more comparable.

The monthly increase of the cattle, singly and in lots, is shown in Table VIII., from which it is seen that No. 5 has a very extraordinary record. It seems that the January and March weighings had each borrowed from February. There is no reason to doubt the accuracy of the weighing, as the total increase over the whole period is normal. Slight diarrhœa in February, succeeded by costiveness in March, would easily account for the anomalous weights. In Lot III. it is necessary to add to the increase of No. 10 the average increase of its fellows, namely, 59 lb. When that correction is made, it is seen that the results here confirm those of the other experimenters. The average increase of the cattle of each lot is—

Lot.	lb.	Lot.	lb.
I.	201	III. . . .	183
II.	178	IV.	169

We may now sum up the results of Experiment X. on the three farms of Shidlaw, Mains of Laithers, and Delnies, comprising the monthly record of forty-four cattle, divided into three lots of twelve each, and one lot of eight, all fed on turnips and straw as their main fodder, along with a concentrated fodder at the rate of 5 lb. per head per day, consisting of meals of various nutrient ratios.

Lot.		SHIDLAW. Increase in four months.	MAINS OF LAITHERS. Increase in five months.	DELNIES. Increase in four months.	Total Increase.
I.	Meal A., with a narrow ratio . .	1101	973	804	2878
II.	Meals B. to E., from a narrow to a wide ratio . . .	940	853	712	2505
III.	Meals E. to B., from a wide to a narrow ratio . . .	1019	946	732	2697
IV.	Meal D., with a wide ratio . . .	882	...	675	...

Nothing is more striking in this experiment than the different measure of success that has attended the feeding on the

TABLE VIII.—Experiment X. Delnies. Monthly Increase of Weight per Bullock.

Lot.	No.	Jan.	Feb.	Mar.	April.	Totals.
		lb.	lb.	lb.	lb.	lb.
I. Meal A, narrow ratio	1	64	16	52	46	178
	2	54	20	12	98	184
	3	38	54	29	79	200
	4	57	51	74	60	242
Total . . .		213	141	167	283	804
II. Meals B to E, narrow to wide ratio	5	70	39	102	47	180
	6	56	56	42	34	188
	7	54	48	40	30	172
	8	34	42	37	59	172
Total . . .		214	107	221	170	712
III. Meals E to B, wide to narrow ratio	9	37	37	75	68	217
	10	34	4	45	39	183
	11	38	42	36	63	179
	12	9	22	66	56	153
Total . . .		118	97	222	226	732
IV. Meal D, wide ratio	13	30	48	62	28	168
	14	11	74	28	38	151
	15	4	54	32	58	148
	16	46	58	58	46	208
Total . . .		91	234	180	170	675
		636	579	790	849	...
Allowance for No. 10		...	33	14	23	...
Grand totals .		636	612	804	872	...

three farms, although the method of feeding was the same on all. It is well worth while to inquire what is the cause of these differences. We have seen as regards Lots II., III., and IV., that at Mains of Laithers the large amount of soluble carbohydrates in the bye-fodder interfered at one time or other with the digestion of the cattle, and that thereby their progress was retarded to some extent. But that objection does not apply to Lot I., where the bye-fodder was simply linseed-cake of ordinary quality ground into meal. An explanation of these results may be looked for in several directions. There is first the age of the cattle, for it has been found that two-year-old cattle make better use of their fodder than three-year-olds. An experiment made by Mr Milne at Mains of Laithers a few years ago proved that very clearly. Then there is the condition as regards fattening in which the cattle find themselves at the beginning of the experiment—the leaner they are, the greater is their progress. The breeding of the cattle is also an important matter, for not only have some breeds a greater fattening tendency than others, but individuals of the same breed may be better bred than others, in the sense that they are derived from a faster feeding stock. The housing and comfort afforded are important matters, and especially the temperature to which they are exposed; and there are many other things included under the term "general management" that have a marked effect upon the progress made by fattening cattle. Lastly, and most important of all, there is to be considered the nutritive quality of the rough fodder which forms the main part of the animal's diet.

At Shidlaw and Delnies the cattle were well-bred English shorthorns in fair condition, while at Mains of Laithers they were cross Irish cattle which had been feeding for some time before the experiment began, and they were probably in a more forward condition. The cattle were all of about the same age, and in the other respects referred to, they were all upon an equal footing, except, of course, as regards the character of their rough fodder, which necessarily differs according to soil and climate, and the quantity of it they consumed.

As all the substances eaten by the cattle were analysed, we have the means of comparing their feeding value, so far as by analysis that can be determined; and we may therefore estimate the total amount of digestible food consumed by the cattle of Lot I. on each of the three farms.

Taking first the Shidlaw lot, they consumed during the first month 140 lb. of Fosterton Hybrid (No. 1), 9 lb. oat-straw (No. 9), and 5 lb. of meal A. The analyses of these are given on p. 331, and the actual amount of nutritive matter in lbs. per head per day digested by the cattle is shown in Table IX.

TABLE IX.—Experiment X. Shidlaw. Food digested daily by Lot I.

			Reference Number.		Total Organic Matter.	Digestible Organic Matter.				
						Albuminoids.	Woody fibre.	Carbohydrates.	Oil.	Total.
		lb.			lb.	lb.	lb.	lb.	lb.	lb.
First Period	Turnips	140		Fosterton Hybrid . .	11.9	1.2	1.4	9.2	.1	11.9
	Straw .	9		Oat-straw . . .	7.0	.2	1.7	1.6	..	3.5
	Meal .	5		Meal A	4.0	1.1	.1	1.4	.5	3.1
					22.9	2.5	3.2	12.2	.6	18.5
				Turnip depression. .		.4	.4	.5	..	.8
				Total digested matter .		2.1	2.8	11.7	.6	17.7
						(Nutrient ratio, 1 : 7)				
Second Period	Turnips	140		Aberdeen yellows . .	12.3	1.3	1.5	9.4	.1	12.3
	Straw .	9		Oat-straw . . .	7.0	.2	1.7	1.6	..	3.5
	Meal .	5		Meal A	4.0	1.1	.1	1.4	.5	3.1
					23.3	2.6	3.3	12.4	.6	18.9
				Turnip depression. .		.4	.4	.5	..	.8
				Total digested matter .		2.2	2.9	11.9	.6	18.1
						(Nutrient ratio 1 : 7.2)				
Third and Fourth Periods	Turnips	146		Swedes	13.9	1.5	1.7	10.0	.1	13.3
	Straw .	6		Oat-straw . . .	4.7	.1	1.1	1.1	..	2.3
	Meal .	5		Meal A	4.0	1.1	.1	1.4	.5	3.1
					22.6	2.7	2.9	12.5	.6	18.7
				Turnip depression. .		.3	.3	.4	..	.6
				Total digested matter .		2.4	2.6	12.1	.6	18.1
						(Nutrient ratio, 1 : 6.8)				

A few words in explanation of the method of calculating the digestible matters from the analysis may be useful to some readers.

The turnips are considered as wholly digestible, so that the digestible constituents of Table IX. are derived directly from the analysis.

It is not the case that turnips are wholly digested, for an animal eating nothing but turnips passes a considerable quantity of dung; but when given in comparatively small quantity, along with a large amount of straw, hay, or other rough fodder, it is believed that no great error is introduced by regarding them as wholly digestible. When given in large quantity, as is the custom in Scotland, and as was the case in this experiment, some allowance must be made for that part of turnips that is not digested. The method I have adopted in this instance is that recommended by Professor Wolff, of making an allowance for what is called "turnip depression," a term which requires some explanation. It has been found that when the dry matter of the turnips eaten exceeds 12 per cent of that of the other fodder used, it exerts a depressing influence on the digestibility of the nutritive constituents contained in the ingredients of the daily ration, and the greater the proportion of turnips in the daily ration, the more severely are the digestible constituents of the rest of the fodder hindered in their digestibility. It is obvious that this method of reckoning is only an attempt to estimate the indigestible matter of the turnip by referring it to the other ingredients of the fodder. It would be much more satisfactory if figures were available by which to express the actual digestibility of the constituents of the turnip, especially when it forms a large proportion of the food eaten.

As the turnips grown in this country are of superior quality, and form usually the main part of the fodder eaten by cattle, it is very desirable that actual feeding experiments should be undertaken to determine its digestibility, and not only its digestibility in a general way, but the digestibility and feeding value of turnips grown under various conditions of soil and treatment. In the absence of reliable data, I have used Wolff's coefficient of depression in attempting to find the quantity of digestible matter consumed by the cattle, and its quality as expressed by the "nutrient ratio." The depression which the quantity of turnips consumed at Shidlaw is regarded as exercising upon the digestibility of the rest of the fodder is—for rough albuminoids, 25 per cent; for woody fibre, 14 per cent; and for carbohydrates, 10 per cent. The only other item requiring explanation is the measure of digestibility taken for the constituents of the oat-straw. These have been well ascertained for straw of average quality—viz., for albuminoids, 51 per cent, for woody fibre, 60 per cent, and for carbohydrates, 46 per cent, of the percentages contained in the analyses, p. 331.

It may seem an extraordinary thing that the woody fibre in

TABLE X.—EXPERIMENT X. MAINS OF LAITHERS. FOOD DIGESTED DAILY BY LOT I.

		Reference Number.		Total organic matter.	Digestible organic matter.				
					Albuminoids.	Woody fibre.	Carbohydrates.	Oil.	Total.
	lb.			lb.	lb.	lb.	lb.	lb	lb.
First Period	Turnips		Yellow turnips	3.3	.5	.4	2.3	..	3.2
	Straw		Oat straw and chaff, early Angus	11.5	.4	1.9	2.7	..	5.0
	Meal		Meal A	4.0	1.1	.1	1.4	.5	3.1
				18.8	2.0	2.4	6.4	.5	11.3
			Turnip depression		.3	.2	.4	..	.5
			Total digested matter		1.7	2.2	6.0	.5	10.8
					(Nutrient ratio, 1 :5.5)				
Second Period	Turnips		Yellow turnips	3.3	.5	.4	2.3	..	3.2
	Straw (Potato oat and early Angus)		Oat straw and chaff, potato oat and early Angus	10.4	.3	2.0	2.7	.1	5.1
	Meal		Meal A	4 0	1.1	.1	1.4	.5	3.1
				17.7	1.9	2.5	6.4	.6	11.4
			Turnip depression		.2	.2	.4	..	.4
			Total digested matter		1.7	2.3	6.0	.6	11.0
					(Nutrient ratio, 1 :5.5)				
Third Period	Turnips		Swedes	5.4	.7	.6	4.0	.1	5.4
	Straw		Straw & chaff (potato oat, early Angus)	9.1	.2	1.7	2.4	.1	4.4
	Meal		Meal A	4.0	1 1	.1	1.4	.5	3.1
				18.5	2.0	2 4	7.8	.7	12.9
			Turnip depression		.2	.2	.3	..	.7
			Total digested matter		1 8	2.2	7.5	.7	12.2
					(Nutrient ratio, 1 : 6.3)				
Fourth Period	Turnips		Swedes	6 7	.9	.8	5.0	.1	6.8
	Straw		Straw as before	9.3	.2	1.7	2.5	.1	4.5
	Meal		Meal A	4 0	1.1	.1	1.4	.5	3.1
				20.0	2.2	2.6	8.9	.7	14.4
			Turnip depression		.2	.2	.3	..	.7
			Total digested matter		2.0	2.4	8.6	.7	13.7
					(Nutrient ratio, 1 : 6.3)				

oat-straw is more digestible than the carbohydrates; but an analysis of the dung of two Norwegian sheep fed for me on straw alone by Mr Boyd of Faldonside for about a fortnight, showed that the digestibility of the woody fibre and carbohydrates agreed closely with the percentages given above.

It is shown in Table IX. that Mr Henderson's cattle consumed daily about 22½ lb. of dry organic matter, of which about 18 lb. was digestible; the amount of albumen began at about 2 lb. per day, and gradually rose to 2½ lb., while the albuminoid ratio remained pretty constantly at about 1 to 7.

In Mr Milne's experiment (see Table X., p. 315) the amount of dry organic matter consumed daily ranged from about 18 to 20 lb.; but the digestible matter contained in it was small, owing to the small amount of turnips and the correspondingly large amount of straw constituting their diet. It began at about 11 lb. per day, and ended at about 14. The digestible albumen began at 1.7 lb. per day, and rose to 2 lb., while the ratio was about 1 to 6, a little narrower at the beginning, but wider at the close.

As to Mr Arres-Mather's experiment, the information is somewhat defective, for no note was taken of the amount of straw the animals ate. We cannot be far off the mark, however, in estimating their consumption of straw at 10 lb. per head per day. That brings the total dry organic matter consumed daily to just about 21 lb. per day.

The straw grown at Delnies, and, indeed, over all the light land of that part of Scotland in 1888, was abundant in quantity but poor in quality. The straw at Delnies contained only about 2 per cent of albumen (see analysis No. 6). The result of the inferior quality of the straw is to reduce the amount of albumen consumed to less than 2 lb. per head per day, and although the turnips were of good quality, the nutrient ratio remained at 1 to 8 during the whole experiment.

For details, see Table XI.

We thus see that the fodder supplied to the three sets of cattle, having regard to the quantity and quality of the food together, sufficiently explains the differences in the amount of progress made by them, as shown in Table XII.

The cattle which ate most organic matter made most live-weight, but not in proportion to the amount eaten, otherwise the Delnies cattle would have increased more rapidly. Neither is the increase in proportion to the respective amounts of *digestible* organic matter consumed, for, had that been so, the Delnies cattle should have made more than 2 lb. daily. Moreover, the increase is not in proportion to the digestible albumen, for in that case the cattle at Mains of Laithers should have been much better than those at Delnies.

If the nutrient ratio were the only important thing, then the Mains of Laithers lot should have been best of all. It is clearly demonstrated in this experiment that the success of feeding, so far as the food itself is concerned, depends on two things,—in the first place, upon the quantity of the digestible food consumed; secondly, upon the quantity of digestible albu-

TABLE XI.—EXPERIMENT X. DELNIES. FOOD DIGESTED DAILY BY LOT I.

During the four Periods.		Reference No.	Total Organic Matter.	Digestible Organic Matter.				
				Albuminoids.	Woody Fibre.	Carbohydrates.	Oil.	Total.
	lb.		lb.	lb.	lb.	lb.	lb.	lb.
Swedes .	84		8.6	.8	1.1	6.7	.1	8.7
Sandy-oat straw .	10		8.2	.1	1.6	2.3	...	4.0
Meal A . . .			4.0	1.1	.1	1.4	.5	3.1
Total . .			20.8	2.0	2.8	10.4	.6	15.8
Turnip depression .				.2	.3	.4	...	.9
Total digested matter				1.8	2.5	10	.6	14.9
				(Nutrient ratio, 1 : 8).				

TABLE XII.

	Shidlaw.	Mains of Laithers.	Delnies.
	lb.	lb.	lb.
Total organic matter consumed daily	22½	19	21
Do. do. digested "	18	12	15
Albumen digested daily . .	2⅓	2	1¾
Nutrient ratio . . .	1 : 7	1 : 6	1 : 8
Average increase per head daily .	2.46	1.74	1.77

men contained in it—or, in other words, upon the ratio between albumen and carbohydrates of the fodder. In the normal dietaries of Professor Wolff, the amount of total dry fodder considered appropriate for fattening cattle is about 25 lb. per 1000 lb. live-weight, but, in order to get animals to consume that amount, the fodder must be appetising. At Mains of Laithers, and also at Delnies, no limit was put upon the amount of fodder which the animals might consume, but that had reference only to the straw of their fodder. The straw of 1888 was of poor quality, and it is to be presumed that it would not be very appetising, so that the cattle would not eat more than was required simply to appease hunger. In order to cause them to eat more, some kind of flavouring material or spice would have been necessary; but in the case of the sandy-oat straw used at Delnies (No. 13), the amount of albumen it contained was so little that the cattle could not have fattened on it, however much they had eaten. In order to attain the composition of fodder required for fattening rapidly, the cattle would have required more turnips or more cake. Even with the very large amount of turnips used at Shidlaw (10 stones per head per day), Mr Henderson mentioned that Lot I. would have eaten more if they had been allowed. They seemed less inclined to eat the linseed-cake meal, and lingered long over it, so that in that case a little flavouring material added to the meal might have had a good effect. The use of spices, whether as appetisers or as aids to digestion, is a matter worthy of investigation, and an experiment is at present being carried out at Mains of Laithers for that purpose. A still more important matter, for the benefit of those who wish to carry out accurate systematic feeding in Scotland, would be experiments to determine the digestibility of the constituents of turnips which form so large a proportion of the dietary of our feeding cattle, but this would require specially constructed stalls, and would involve a good deal of trouble and expense.

The answers to the questions given by these results are, that a bye-fodder having a narrow ratio is more appropriate and economical for feeding cattle than one with a wide ratio; and that it is better to begin with a bye-fodder having a wide ratio, and to gradually narrow the ratio from month to month, than to begin with a bye-fodder having a narrow ratio, and to gradually widen it.

These experiments show clearly the usefulness of the *nutrient ratio* as a guide in conducting feeding operations, and as preliminary experiments they have been of great service in preparing the way for others whose object is to define with some precision the most appropriate and economical nutrient ratio for fattening purposes.

EXPERIMENT XI.

Whether is it more profitable to increase the proportion of oil or the proportion of easily digestible carbohydrates (sugar) in the dietary of feeding cattle that are being brought forward on turnips and straw with an allowance of bean-meal?

This experiment was carried out by Mr John Milne, Mains of Laithers, and Mr William Scott, Corsiestone, Huntly.

The method of the experiment was as follows: Out of sixteen cattle, whose weights were known, and which had been fed for a fortnight on an equal quantity of turnips and 5 lb. of bean-meal per head per day, with straw *ad libitum*, twelve of the most suitable were selected, and divided into three even lots of four each. A four months' experiment then began, in which all the lots received daily an equal quantity of turnips and bean-meal (No. 24). At the beginning of a new month the quantity of turnips might be increased to the same extent over all the lots, but the amount of bean-meal remained steady at 5 lb. per head per day during the whole time. Straw was eaten *ad libitum*, but the amount eaten monthly by each animal was noted. So far all the cattle were upon an equal footing during the whole four months.

In addition to this dietary, Lot II. received daily half a pound each of linseed-oil the first month, and three-quarters of a pound each during the other three months, while Lot III. received daily one pound of sugar the first month, and two pounds of sugar thereafter. The only differences in the feeding were therefore that Lot I. got neither oil nor sugar; Lot II. got oil; and Lot III. got sugar.

The object of the experiment was to see whether this additional oil or sugar would be conducive to the progress of the stock, and profitable to the feeder.

The quantity of oil was considered such as the animals would be able to digest without difficulty, and the quantity of sugar was that which is commonly regarded as equivalent in feeding value to the oil. From theoretical considerations, 1 lb. of oil is regarded as equivalent to very nearly 2½ lb. of pure dry sugar, so that after deducting 10 per cent of water contained in the sugar used, it is seen that that ratio was very closely adhered to. These quantities of oil and sugar respectively represent very nearly the same money value.

We may take first the results of Mr Milne's experiment. The cattle were two-year-olds, cross-bred steers and heifers, and as even a lot of animals as could be procured. They were all under the same roof, and kept under exactly similar conditions. The straw was supplied in weighed bundles, which were renewed constantly as the consumption went on, and an accurate account kept of the bundles supplied to each. No straw was used for litter, so that any of it that might have got among the feet of the cattle was removed and deducted from the total quantity supplied. During the first two months yellow turnips (No. 4) were given at the rate of 50 lb. per head per day; during the third month 60 lb. of swedes, and thereafter 75 lb. of swedes (No. 5). The turnips were pulped and mixed with 2½ lb. of chaff or cut straw. The weight of these is included in the amount of straw consumed. The oil and sugar were given thrice daily mixed with the bean-meal. The cattle were weighed at the end of each month, or rather at the end of each period of twenty-eight days, on the same day of the week and at the same time of day, with perfect regularity. The results of the weighings and the amount of straw consumed by each lot are contained in Table XIII.

The weights of the cattle at the beginning of the first period show how carefully they were selected, and the total weight of each lot at the close of each period shows how they progressed under the different dietaries.

The experiment was continued for five months, and if we deduct the weights at the beginning from those at the end of the fifth month, we find that the increase of each lot was as follows:—

	Per Lot.			Per Head.	
Lot.	cwt.	qr.	lb.	cwt.	lb.
I. Turnip, straw, and bean-meal .	8	1	2	2	7
II. Turnip, straw, bean-meal, and linseed-oil	9	3	0	2	49
III. Turnip, straw, bean-meal, and sugar	7	2	14	1	101

The lot receiving oil gained 166 lb. over the lot that had none, but that increase was got at the cost of 392 lb. of linseed-oil, or 2⅓ lb. of oil for one pound increase in live-weight, so that with oil at 2d. per lb. the price of cattle would require to be upwards of 5d. per lb. live-weight to leave a profit to the feeder.

The cattle of Lot III., receiving sugar of equal money value to the oil, were hindered in their feeding. Each of them was off its feed at one time or other, but it was during the first month, when receiving only 1 lb. per head per day, that they were most disturbed in their digestion. They took the sugar very greedily, and it was probably more to the bolting of the sugar than to the total amount consumed that indigestion was due. It is in this respect that oil or sugar given in mass is less appropriate than the same amount of these contained in the food itself.

In this experiment, as in No. X., we meet with extraordinary fluctuations in the weights of the cattle from month to month, as

TABLE XIII.—EXPERIMENT XI. MAINS OF LAITHERS.

	Lot I.				Lot II. (with Oil).				Lot. III. (with Sugar)			
	No.	Weight of Animal.			No.	Weight of Animal.			No.	Weight of Animal.		
		cwt.	qr.	lb.		cwt.	qr.	lb.		cwt.	qr.	lb.
At beginning of first period	1	9	0	21	5	9	2	27	9	9	1	14
	2	8	2	23	6	8	2	7	10	8	1	11
	3	8	3	26	7	9	1	21	11	9	3	7
	4	9	1	11	8	8	3	1	12	9	1	9
Total . . .		36	0	25		36	2	0		36	3	13
At end of first period	1	9	2	3	5	10	0	6	9	9	1	23
	2	9	0	8	6	8	3	21	10	8	2	13
	3	9	0	19	7	9	2	23	11	9	3	16
	4	9	2	17	8	9	0	23	12	9	1	4
Total . . .		37	1	19		37	3	17		37	1	0
Straw per head per day .				15.68				14.37				15.24
At end of second period	1	9	3	24	5	10	3	16	9	10	0	0
	2	9	1	10	6	9	1	14	10	8	3	21
	3	9	2	0	7	10	1	4	11	10	1	16
	4	10	1	7	8	9	2	0	12	9	2	20
Total . . .		39	0	13		40	0	6		39	0	1
Straw per head per day .				14.23				12.12				13.22
At end of third period	1	10	2	3	5	11	1	8	9	10	2	8
	2	9	3	6	6	9	3	13	10	9	1	19
	3	10	0	7	7	10	3	12	11	10	3	6
	4	10	0	27	8	10	0	2	12	10	1	7
Total . . .		40	2	15		42	0	7		41	0	12
Straw per head per day .				12.12				11.23				11.76
At end of fourth period	1	11	0	6	5	12	0	18	9	10	3	0
	2	10	1	13	6	10	3	3	10	9	2	24
	3	10	2	7	7	11	2	23	11	11	1	14
	4	11	0	16	8	10	3	6	12	10	3	21
Total . .		43	0	14		45	1	22		42	3	3
Straw per head per day .				12.52				11.07				11.54
At end of fifth period	1	11	1	11	5	12	1	21	9	11	0	20
	2	10	3	0	6	11	0	7	10	10	0	16
	3	10	3	16	7	11	2	16	11	11	3	19
	4	11	2	0	8	11	0	12	12	11	1	0
Total . . .		44	1	27		46	1	0		44	1	27
Straw per head per day .				13.27				11.77				12.14

seen in Table XIV., in which the individual increase of the cattle each month is given.

TABLE XIV.—EXPERIMENT XI. MAINS OF LAITHERS. MONTHLY INCREASE PER BULLOCK (lb.)

Lot.	No.	Dec.	Jan.	Feb.	March.	April.	Total.
I. . .	1	38	49	63	59	33	242
	2	41	30	52	63	43	229
	3	21	37	63	56	37	214
	4	34	74	−8	101	40	241
Total . .		134	190	170	279	153	926
II. With oil .	5	35	94	48	94	31	302
	6	42	49	55	102	32	280
	7	30	65	64	95	−7	247
	8	50	33	58	88	34	263
Total . .		157	241	225	379	90	1092
III. With sugar	9	9	61	64	20	48	202
	10	30	36	54	33	48	201
	11	9	56	46	64	61	236
	12	−5	44	71	70	35	215
Total . .		43	197	235	187	192	854
Totals		334	628	630	845	435	...

No. 4, after making unusual progress in January, lost 8 lb. in February, and gained 101 lb. in March, without any apparent reason. No. 6, after going on steadily for three months, putting on about 50 lb. per month, made a sudden increase of 102 lb. in March. In Lot III. the only animal that made normal progress was No. 10. The others were all affected with indigestion. No. 12 lost weight the first month, and had to be removed and his place supplied by another of similar weight.

Lot I. made best progress in the month of March, and Lot II.

made extraordinary progress in that month. Still more remarkable was their falling away in the following month. It was fortunate that Mr Milne continued his experiment for a month longer than was originally intended, otherwise we might have been left to suppose that the improvement made by Lot II. in March would have been continued thereafter, in which case the oil would have shown itself to be a profitable bye-fodder. As it happened, all the oil-fed cattle suddenly stopped growing, and one of them (No. 7) actually lost weight. The lot that did best in April was the sugar-fed lot. Mr Milne is unable to explain the poor results of feeding in the month of April, but he has observed, over a course of many years, that his cattle usually do worst in April, although the conditions of their feeding remain the same as the month before. The total numbers on the lowest line of the table show that, even despite the improvement in the lot eating sugar, the gain was only half what it was in the preceding month.

The answer which this experiment gives to the questions proposed is, that it is not profitable to give oil as a bye-fodder, and it is still less profitable to give sugar, at least when given in the quantities and in the manner employed in this case. Perhaps if half as much had been given, the result would have been better, for it must be kept in mind that the ill success of the fodder was in great measure due to the occurrence of indigestion. In this case there was no bolting of the oil or sugar, for it was thoroughly mixed with the meal and given in three daily doses.

It may be that these cattle were more delicate in their digestion than cattle of a coarser breed, or it may be that the warmth and comfort they enjoyed in a large and well-constructed house where a very large number of cattle are kept together, rendered them less able to digest so much carbonaceous fodder as is required in ordinary circumstances; but, whatever the reason, it is desirable that a similar experiment be made with smaller quantities.

The experiment of Mr Scott, Corsiestone, was made with a less equal lot of two-year-old cattle, weighing at the beginning from 6½ to 10½ cwts. They received each 72 lb. of turnips (yellows (No. 7) the first month and swedes (No. 8) thereafter), 12 lb. of straw (No. 10), and 4 lb. of bean-meal (No. 24) per head per day, but the same quantities of oil and sugar as in the former case. In this case no symptoms of indigestion occurred, and the cattle did well from beginning to end of the experiment, with the exception of No. 5, which was ill for some time, and unable to take the whole of his fodder. In order to obtain accurate results, it would be necessary to remove this bullock from the experiment, or what comes to the same thing, credit him with the average increase of the other three of Lot II. in estimating the total increase of that lot.

Besides the three lots specified, Mr Scott fed a fourth lot on the same amount of turnips and straw, but instead of bean-meal he gave them a mixture of crushed oats and barley, 5 lb. per head per day, and along with that 1½ lb. of crushed linseed during the first month, and 2¼ lb. of it during the succeeding months. His object in so doing was to see if the linseed-oil, given in the natural state in which it occurs in linseed, would be more advantageous than the oil given in mass.

The quantities of crushed grain and linseed he used contained just about the same quantities of albumen and oil as were given in the dietary of Lot II., so that the comparison is a fair one between these two lots. The weight of the cattle from month to month is shown in Table XV.

The gains in live-weight from 17th December to 8th April were:—

		Increase			
		Per Lot.		Per Head.	
Lot		cwt.	lb.	cwt.	lb.
I.	Turnip, straw, and bean-meal . . .	7	105	1	110
II.	Do. do. and oil . .	8	0	2	0
III.	Do. do. and sugar .	8	14	2	3½
IV.	Do. and crushed grain and linseed	8	7	2	2

The total increase of Lot II. suffers from the loss of weight sustained by bullock No. 5 during its illness. If instead of its increase is substituted the average increase of the other three in the lot, the total increase would be 8 cwt. 47 lb., or 2 cwt. 12 lb. per head.

This has been done in Table XVI. (p. 326), where the increase of each bullock from month to month is shown.

In this instance, as in the case of Mr Milne's cattle, the fluctuations in increase from month to month are considerable, but upon the whole these cattle made more steady progress, and their total increase of weight during the first four months was greater than those at Mains of Laithers. That is to be accounted for by the leaner condition they were in at the beginning of the experiment. It is also seen that the lots were not very even. Lot III. weighed on an average fully 2 cwts. per head heavier than Lot II., and the accuracy of the experiment suffers to some extent from that circumstance. An interesting fact is brought to light in comparing the total increase of the whole sixteen cattle in the different months, as shown in the last line of Table XVI. The increase in the second period was much less than in the first, and it was still less during the third period; but in the fourth period there was again a large increase. The cause of the deficient progress in the third period was most

TABLE XV.—EXPERIMENT XI. CORSIESTONE.

	Lot I.			Lot II. with Oil.			Lot III. with Sugar.			Lot IV. with Grain and Linseed.		
	No.	Weight of Animal.		No.	Weight of Animal.		No.	Weight of Animal.		No.	Weight of Animal.	
		cwt.	lb.		cwt.	lb.		cwt.	lb.		cwt.	lb.
At beginning of first period, 17th Dec.	1	7	14	5	6	35	9	9	0	13	8	35
	2	8	84	6	6	35	10	10	77	14	8	49
	3	8	7	7	7	84	11	8	77	15	9	84
	4	7	84	8	9	42	12	10	7	16	7	105
Total. .		30	77		29	84		38	49		34	49
At end of first period, 14th Jan.	1	7	63	5	6	84	9	9	77	13	9	7
	2	8	21	6	6	77	10	11	21	14	8	105
	3	8	77	7	8	35	11	9	35	15	10	49
	4	8	28	8	10	21	12	10	77	16	8	42
Total. .		32	77		31	105		40	98		36	56
At end of second period, 11th Feb.	1	8	105	5	7	0	9	10	42	13	9	42
	2	8	77	6	7	21	10	11	77	14	9	28
	3	9	21	7	8	77	11	9	91	15	10	105
	4	9	105	8	10	63	12	11	7	16	9	14
Total. .		34	84		33	49		42	105		38	77
At end of third period, 11th March	1	8	38	5	7	45	9	10	80	13	9	87
	2	9	24	6	7	101	10	12	24	14	9	73
	3	9	52	7	9	10	11	10	17	15	11	38
	4	9	45	8	11	3	12	11	52	16	9	59
Total. .		36	47		35	47		44	61		40	33
At end of fourth period, 8th April	1	9	0	5	8	0	9	11	28	13	10	56
	2	9	98	6	8	70	10	12	70	14	10	14
	3	9	98	7	9	70	11	10	63	15	11	105
	4	9	98	8	11	56	12	12	14	16	9	105
Total. .		38	70		37	84		46	63		42	56

TABLE XVI.—EXPERIMENT XI. MONTHLY INCREASE OF WEIGHT PER BULLOCK (lb.) CORSIESTONE.

Lot.	No.	December and January.	January and February.	February and March.	March and April.	Totals.
I.	1	49	42	45	74	210
	2	49	56	59	74	238
	3	70	56	31	46	203
	4	56	77	52	53	238
Total . . .		224	231	187	247	889
II. With oil . .	5	65	47	59	65	236
	6	42	56	80	81	259
	7	63	42	45	60	210
	8	91	42	52	53	238
Total . . .		261	187	236	259	943
III. With sugar .	9	77	77	38	60	252
	10	56	56	59	46	217
	11	70	56	38	46	210
	12	70	42	45	74	231
Total . . .		273	231	180	226	910
IV. With crushed grain and linseed	13	84	35	45	81	245
	14	56	35	45	43	179
	15	77	56	45	67	245
	16	49	84	45	46	224
Total . . .		266	210	180	237	893
Totals . .		1024	859	783	969	...

probably the low temperature then prevalent. A tack of frosty weather occurred during February and March, and the cattle, although comfortably housed, were far more under the influence of temperature changes than those in the large and well-constructed cattle-house at Mains of Laithers. Two doors opened into the court immediately behind the cattle, and according to the direction of the wind the different lots would be unequally exposed to cold draughts.

As regards the answer given to the questions proposed in the experiment, the results at Corsiestone corroborate in the main those at Mains of Laithers. It evidently does not pay to give an addition of oil or sugar to feeding cattle. The cattle of Lots II. and III. are very little better than Lot I., so that the money spent on oil and sugar has practically been lost.

It would have been instructive if another lot of cattle had been fed on turnips and straw alone, in order to see if even the bean-meal used as a bye-fodder had been a good investment. It does not seem that the oil given in the linseed of Lot IV. was in any degree better than that given in mass to Lot II. As it happens, that lot was somewhat backward, but the differences exhibited by the different lots are not great, and not to be too narrowly appraised when we consider how widely the weights of the animal have fluctuated during the course of the feeding experiment.

More frequent weighing would have been of great use in this as in the other experiments. The sudden drop in the weight of cattle on the occurrence of frosty weather would then have been made more evident, and we should have had some more reliable evidence of the economy of artificial heating of byres and cattle-houses during severe winters. This evidence is supplied by the results of Experiment XIII. with yearling cattle. The questions proposed, however, have been very clearly answered, but it is desirable that a similar experiment should be tried with smaller quantities of oil and sugar.

EXPERIMENT XIII.

To determine whether, in wintering young cattle on turnips and straw along with an allowance of concentrated fodder, the latter should be given in the form of cake or corn, or a mixture of these.

This experiment was carried out by Mr Wm. Scott, Corsiestone, who selected twelve yearlings of fairly equal quality, and divided them into four lots of three each. These were all tied up and fed upon an equal ration of 51 lb. yellow turnips (No. 7) and 8 lb. straw (No. 10), along with the following bye-fodders (Nos. 20-23):—

Lot.	Per head per day.
I.	1½ lb. linseed-cake meal.
II.	¾ lb. linseed-cake meal, and 1¼ lb. crushed corn (an equal mixture of crushed oats and barley).
III.	¾ lb. bean-meal, and 1¼ lb. crushed corn.
IV.	1¼ lb. bran, and 1¼ crushed corn.

These quantities all represented the same money value—viz., three-halfpence per head per day. The experiment began on 17th December 1888, and ended on 8th April 1889.

The cattle were weighed every twenty-eight days, and the weighings are shown on Table XVII.

Table XVIII. (p. 330) shows the monthly increase of the young cattle individually and in lots.

The general result is, that there is no very great difference in the progress of the young stock consuming the same money value of these bye-fodders, but what differences there are seem to be in favour of a mixture of cake and corn. It would not be safe, however, to draw conclusions too absolutely from this experiment, seeing that there were only three cattle in each lot, and knowing as we do how much the effects of feeding are influenced by the individual peculiarities of cattle. In this experiment Lot I. can scarcely be regarded as satisfactory, with a difference of 63 lb. of increase between No. 1 and No. 3. It cannot be said that the unsatisfactory progress of No. 3, which is the worst of the whole twelve, was the result of its fodder, for No. 1 fed in the same way is the second best of the twelve.

In Lot II., on the other hand, we can scarcely consider the rapid progress of No. 6 as due chiefly to its feeding, when No. 5 is 49 lb. behind it. The increase of No. 6 in the second period is quite exceptional, and it is very probable that if it and No. 3 had changed places, Lot I. would have been nearly 80 lb. better, and Lot II. nearly 80 lb. worse.

It is quite evident from this, and also from the other feeding experiments described in the preceding pages, that three or four animals is too small a number on which to base the effects of a feeding experiment. It would be necessary to have double that number. With eight animals in each lot, it would be easy to set aside the record of any one or two animals of a lot that showed extraordinary results, and we should then have reliable data at our command. Of course, it would come to the same thing if a number of feeders were trying the same experiment with small lots, but this experiment stands alone.

The only reliable result obtained in this experiment is what is contained on the last line of the table—what are called the grand totals. The great decrease in the progress of the cattle during the latter half of February and the former half of March, corroborating as it does the results obtained with the cattle of

TABLE XVII.—EXPERIMENT XIII. CORSIESTONE.

	No.	Lot I. Linseed-cake.		No.	Lot II. Cake and Corn.		No.	Lot III. Bean-meal and Corn.		No.	Lot IV. Bran and Corn.	
		cwt.	lb.		cwt.	lb.		cwt.	lb.		cwt.	lb.
Beginning of first period, 17th Dec. 1888	1	4	98	4	4	56	7	4	49	10	3	98
	2	4	21	5	3	49	8	4	77	11	4	0
	3	4	0	6	4	35	9	4	49	12	4	21
Total . .		13	7		12	28		13	63		12	7
End of first period, 14th Jan. 1889	1	5	49	4	5	0	7	4	91	10	4	35
	2	4	49	5	3	84	8	5	42	11	4	49
	3	4	28	6	4	63	9	4	91	12	4	49
Total . .		14	14		13	35		15	0		13	21
End of second period, 11th Feb.	1	6	7	4	5	77	7	5	42	10	4	84
	2	5	0	5	4	28	8	5	98	11	4	98
	3	4	84	6	5	63	9	5	42	22	5	14
Total . .		15	91		15	56		16	70		14	84
End of third period, 11th March	1	6	52	4	6	10	7	5	108	10	5	3
	2	5	45	5	4	94	8	6	17	11	5	31
	3	5	17	6	6	10	9	5	94	12	5	73
Total . .		17	2		17	2		17	107		15	107
End of fourth period, 8th April	1	7	7	4	6	70	7	6	56	10	5	84
	2	6	14	5	5	35	8	6	70	11	5	98
	3	5	70	6	6	70	9	6	42	12	6	35
Total . .		18	91		18	63		19	56		17	105

Experiment XI. (see p. 326), is a valuable piece of information. It shows how very much the progress of cattle, and especially of young cattle, is retarded by cold. It is evident that in

TABLE XVIII.—EXPERIMENT XIII. CORSIESTONE. MONTHLY INCREASE IN WEIGHT OF CATTLE.

Lots.	No.	14th Jan.	11th Feb.	11th Mar.	8th April.	Total Increase.
		lb.	lb.	lb.	lb.	lb.
I. Linseed-cake	1	63	70	45	67	245
	2	28	63	45	81	217
	3	28	56	45	53	182
Totals . .		119	189	135	201	644
II. Linseed-cake and corn . .	4	56	77	45	60	238
	5	35	56	66	53	210
	6	28	112	59	60	259
Totals . .		119	245	170	173	707
III. Bean-meal and corn . .	7	42	63	66	60	231
	8	77	56	31	53	217
	9	42	63	52	60	217
Totals . .		161	182	149	173	665
IV. Bran and corn .	10	49	49	31	81	210
	11	49	49	45	67	210
	12	28	77	59	74	238
Totals . .		126	175	135	222	658
Grand totals .		525	791	589	769	...

this case it would have been profitable to keep the cattle-house warm by the consumption of fuel, for the animals have evidently been using their food as fuel to maintain their temperature; and if a cattle-shed is so constructed or so situated as to

TABLE XIX.—ANALYSES OF FODDERS USED IN FEEDING. EXPERIMENTS X., XI., AND XIII.

No.		Moisture.	Ash.	Organic Matter.	Nitrogen × 6.25. a	Albumen. b	Difference a − b	Woody Fibre.	Carbo-hydrates.	Oil.
	TURNIPS.									
1	Fosterton hybrid, Henderson	90.92	.58	8.50	.85	.55	.30	1.00	6.55	.1
2	Swedes, do.	90.25	.58	9.17	1.02	.86	.16	1.19	6.86	.1
3	Greentop white, do.	91.13	.64	8.23	.78	.55	.23	.89	6.46	.1
4	Yellows, Milne . .	92.64	.69	6.67	1.00	.64	.36	.88	4.69	.1
5	Swedes, do. . .	90.35	.66	8.99	1.16	.84	.32	1.07	6.66	.1
6	Swedes, Arres-Mather	89.16	.54	10.30	.97	.59	.38	1.27	7.96	.1
7	Yellows, Scott . .	91.36	.86	7.78	1.13	.85	.28	.73	5.82	.1
8	Swedes, do. . .	90.08	.72	9.20	1.26	.96	.36	1.04	6.80	.1
	STRAW.									
9	Potato oat, Henderson	11.90	10.15	77.95	4.37	3.06	.71	32.45	41.13	..
10	Do. Scott .	11.80	9.35	78.85	4.60	3.95	.65	25.80	48.02	.43
11	Do. Milne .	13.65	12.20	74.15	4.81	4.37	.44	23.95	45 39	..
12	Early Angus, do. .	10.60	7.55	81.85	3.50	3.06	.44	29.25	48.75	.35
13	Sandy oat, Arres-Mather	11.95	5.65	82.40	2 41	1 97	.44	26.80	52.32	87
14	Oat chaff, Milne .	13.25	18.25	68.50	5.91	4.81	1.10	15.40	47.19	..
	MEAL, &c.									
15	Exper. X., meal A .	14.6	5.0	80.4	26.2	25.6	.6	7.1	36.3	10.5
16	Do. B .	13.8	4.1	82.1	19.5	19.2	.3	5.4	46.8	10 0
17	Do. C .	13.0	3.0	84.0	13.6	13.6	.0	3.7	56.5	9.5
18	Do. D .	11.5	2.2	86.4	9.2	9.6	.0	2.6	64.6	9.3
19	Do. E .	10.8	1.7	87.5	8.5	7.5	1.0	2.0	69.5	8.3
20	Exper. XIII., meal I.	14.5	7.5	78.0	24.0	21.9	2.1	9.2	34.8	9.8
21	Do. II.	14.4	4.4	81.2	16.2	15.4	.8	8.6	51.	6.2
22	Do. III.	14.3	2.7	84.0	16.8	15.0	1.8	8.7	56.	3.1
23	Do. IV.	13.0	4.1	82.9	13.7	11.6	2.1	9.0	56.	3.9
24	Bean-meal . . .	14.4	3.5	82.0	22.6	20.3	2.3	7.9	47.3	4.2
25	Mixed meals . .	10.8	3.8	85 3	14.0	12.5	1.5	5.0	50.2	16.1
26	Ground maize . .	15.0	1.7	83.3	10.5	..	..	1.5	67.5	3.8
27	Locust-beans . .	12.9	3.2	83.9	5.4	..	..	4.5	69.4	4.6
28	Ovens' cake . .	15 2	4.7	80.1	26.2	..	..	4.3	44.5	5.0
29	Sugar	..	..	..	..	..	..	..	91.2	..

be exposed to cold winds, it would certainly be more economical to burn coals than to burn fodder.

After the experiment was over, and the young cattle had been turned out to graze, Mr Scott took note of their progress. He found that Lot III., which seemed to fatten rather than to grow during the experiment, did not do so well as the others on the grass. The lots that did best on the grass were Lots I. and II., which got linseed-cake meal, and in whose fodder there was a higher percentage of oil.

AGRICULTURAL EXPERIMENTS BY LOCAL SOCIETIES.

MANURIAL EXPERIMENTS.

In 1888 a number of local societies carried out an experiment whose object was to determine whether soluble or insoluble phosphates were most appropriate for application to the turnip crop, and further to determine whether bone phosphate, mineral phosphate, or slag phosphate was most economical for that purpose.

The details were reported in the former volume of the 'Transactions,' pp. 214-227, and while the results necessarily varied, according to the nature of the soil, in each case there was brought out clearly the fact that superphosphate and Thomas-slag were at once the most appropriate and economical for most soils. The fact that the cheapest forms of phosphate were also the best was a gratifying surprise to most of the experimenters; and a general desire was expressed to continue the experiment another year, for it was rightly considered that the wetness of the season might have very materially affected the relative usefulness of the manures. Another circumstance which rendered it desirable to continue the experiment was the kind of nitrogenous manure applied along with the phosphates. For reasons which are described in the report, meat-meal was selected. This is an insoluble form of nitrogenous manure, and also a very dear one; but inasmuch as the efficacy of a phosphate depends in great measure upon the activity of the nitrogenous matter which is applied along with it, especially on soils poor in nitrogen, it was considered desirable that in the succeeding trials a part of the nitrogenous manure should be given in a soluble form on one of the plots, and a still more important question arose as to what is the most favourable proportion of nitrogenous manure to apply along with phosphates.

In order to test these questions the following experiment was arranged:—

Experiment II.

To discover the most appropriate and economical turnip manure.

1. Should the phosphates be soluble or insoluble?
2. Should the phosphates consist of bone, mineral phosphate, or Thomas-slag?
3. Should the nitrogenous manure be soluble or insoluble, or a mixture of these?
4. What proportion should the phosphates bear to the nitrogen?

Kinds of manure:—

Fine bone-meal.—50 per cent phosphate, 5 per cent ammonia.
Vitriolated bones.—16 per cent soluble phosphate, 21½ per cent insoluble phosphate, 3 per cent ammonia.
Charleston phosphate (finely ground).—57 per cent phosphate.
Superphosphate.—29 per cent soluble phosphate.
Thomas-slag (finely ground).—38 per cent phosphate.
Organic manure.—7 per cent ammonia (insoluble).
Sulphate of ammonia.—24½ per cent ammonia.

Quantities of Manure for Plot of $\frac{1}{40}$ Acre. Plot.		lb.	Cost per Acre. s.	 d.
1.	Fine bone-meal	10	21	6
2.	Vitriolated bones	13½	28	6
	Organic manure	1½		
3.	Ground Charleston phosphate	9	18	0
	Organic manure	7		
4.	Superphosphate	17	23	6
	Organic manure	7		
5.	Thomas-slag	13½	17	6
	Organic manure	7		
6.	Organic manure	7	8	6
7.	Superphosphate	17	24	0
	Organic manure	3½		
	Sulphate of ammonia	1		
8.	Superphosphate	17	24	0
	Sulphate of ammonia	2		
9.	Superphosphate	17	22	0
	Sulphate of ammonia	1½		
10.	Superphosphate	17	20	0
	Sulphate of ammonia	1		

These quantities are so arranged that each plot receives exactly the same amounts of phosphate from whatever source. The prices are those prevalent at the time.

The first six manures were similar to those employed in 1888, excepting as regards the nitrogenous constituent, which was an organic substance of an insoluble but easily decomposable kind, and very much cheaper than meat-meal, which is now a very dear source of nitrogen. On plot 7, the nitrogen was supplied in equal proportions from this source and from sulphate of ammonia; and plots 8, 9, and 10 were set apart to determine what is the most economical proportion in which to supply ammonia along with phosphate in a turnip manure. It is the opinion of many good farmers that a great deal of money is lost in over-dosing turnips with nitrogenous manures, especially where farmyard manure is applied, and these three plots will be found to give conclusive evidence in support of that opinion.

Before presenting the details of the various experiments, a few words regarding the character of the season and the circumstances affecting the experiment must be noted. A far more important matter than the kind of manures used for the turnip crop, is the kind of tilth or "tid" which the farmer secures while putting in his seed, and the kind of weather which follows. In what is known as a good turnip year, the kind of artificial manure used becomes a matter of secondary importance; and, on the other hand, if a bad tilth occurs, especially on the heavier class of soils, or if extreme drought prevails after sowing, light manures may altogether fail to assist the growth of turnips. This was clearly shown in the turnip crop of 1889. In most parts of the country the early sown turnip-seed came away vigorously, and the plants were able to make good use of the light manures applied to them, but with the late sown seed the case was very different. Owing to the drought it germinated very slowly, and in some parts of the country the crop was so irregular and so blanky, that on many farms where the experiment was laid down, the committees in charge of it considered that the manures had not had a fair trial, and that it would be better to send in no report. Owing to this circumstance the number of reports is far short of what it should have been.

In the majority of cases the manures were applied to land which had been dunged in autumn, or along with dung applied in the drills at the time of sowing. This is the usual practice in putting in the turnip crop in most parts of the country, and, in the view of many farmers, it is only right that any experiments with turnip manures should be made in conformity with the general practice of each district. There is much to be said in favour of that opinion; nevertheless it is obvious that in experimenting with manures on small plots of one-fortieth of an acre an uneven distribution of farmyard manure would very materially affect the accuracy of the experiments, and it may be that some of the exceptional results recorded are due to that cause. It is of the first importance to a successful trial of light manures along with dung, that the latter should be of uniform quality, and applied with great evenness over the section of the field on which the trial is being made. In the great majority of cases this matter has been most carefully attended to by the experimenters and the committees under whose direction the tests were made, so that if here and there irregularities are noticed they can only slightly affect the general accuracy of the results where so many experimenters are engaged. This is the great advantage attained by having experiments conducted simultaneously by a large number of farmers scattered over a wide area of country. We are, therefore, entitled to place confidence in the general accuracy of the experiments contained in this report. There is no doubt, however, that where possible it is better that experiments with light manures should be made on land that has not been dunged. In many parts of the country the old-fashioned practice of applying all the dung of the farm to the fallow crops is falling into disuse, and I am strongly of opinion that that is a movement in the right direction. On no part of the farm is dung less economically applied than on the fallow break, for it is in such circumstances that the soluble and most efficient part of the dung is most liable to be lost. Where it is the custom to apply farmyard manure to the different crops of the rotation, and especially to grass, there is not only a far greater economy in the use of that most important of all manures, but there is an evener distribution of the dung over the land, which makes it possible to employ light manures with greater accuracy and success.

The manures supplied are shown in Table I. (p. 336). On one side is given the analyses of the manures as required, and on the other the manures as supplied, and they were as nearly correct as could be expected.

The chief departure from the specification is in the superphosphate, which, besides containing the amount of phosphate wanted in the soluble state, had about one-sixth more phosphate in an insoluble form. It is probable that on that account the results with superphosphate are slightly higher than they ought to be.

We shall in the first place examine the results obtained by the Border Union Association.

Owing to the circumstances mentioned, less than half of the experiments were considered so reliable as to make it advisable to send in their reports—viz., those of

Mr JOHN FULTON, Hatchednize.
Mr WALTER RUTHERFORD, Crailing Tofts.
Mr JOHN A. BELL, Ploughlands.
Mr W. LYLE, Nisbet Mill.
Mr R. COLLEY-SMITH, Ormiston.
Mr GEORGE HENDERSON, Shidlaw, *Secretary.*

The results are contained in Table II.

It is seen that the questions asked in the experiments have been very well answered.

1. The soluble phosphate is in general better than the insoluble. The only exception is on Nisbet Mill, whose light sandy soil seems more adapted for insoluble than for soluble phosphate. Thus bone-meal and ground mineral phosphates have done better than either dissolved. The results of plots 7 and 8 do not contradict this conclusion, for on these plots a considerable amount of insoluble phosphate was applied in addition to the soluble phosphate; and this excess gives the last four plots an advantage over the others.

TABLE I.

No.		Required.			Found.		
		Soluble Phosphate.	Insoluble Phosphate.	Ammonia.	Soluble Phosphate.	Insoluble Phosphate.	Ammonia.
1	Bone-meal, &c. . .	...	50	5	...	50.8	4.7
2	Vitriolated bones, &c. .	19.3	14.4	3.4	21.5	12.9	3.4
3	Ground phosphate .	...	32.1	3.1	...	34	3.2
4	Superphosphate . .	20.5	...	2.1	19.3	3	2.2
5	Slag	...	25	2.4	...	26.5	2.2
6	Organic manure . .	...	...	7	...	...	7.2
7	Superphosphate, organic manure, and sulphate of ammonia	23	...	2.3	24	5	2.2
8	Superphosphate and sulphate of ammonia	26	...	2.6	27.5	4	2.8
9	Do.	27	...	1.9	27	5.5	1.9
10	Do.	27.4	...	1.4	28.7	3	1.4

2. The most economical phosphate is again Thomas-slag, for it has produced not only the largest crop of the first five plots set apart to determine that question, but it is the cheapest manure of the series.

3. It is evident that there is distinct advantage in having the nitrogenous manure for turnips for the most part, if not entirely, soluble. The only experiments which raise any

TABLE II.—EXPERIMENT II. BORDER UNION FARMERS, 1889.

	Farm	HATCHEDNIZE.		CRAILING TOFTS.		PLOUGHLANDS.		NISBET MILL.		SHIDLAW.		ORMISTON.			
	Soil	Light loam		Fine loam		Medium clay		Sandy		Medium clay		Light loam			
	General manure	Dung		None		None		None		None		Autumn dung		Average	
	Per acre—	tons.	cwt.	tons.	cwt.	tons.	cwt.	tons.	cwt.	tons.	cwt.	tons.	cwt.	tons.	cwt.
1	Bone-meal organic manure	27	11	25		14	1	28	10	25	3	25	3	24	4¾
2	Vitriolated bones "	25	6	26		20	2	26	8	26	5½	25	16¾	24	19¾
3	Ground phosphate "	22	7	23		17	5	27	12	25	14	29	1½	24	3¼
4	Superphosphate "	27	12	24		17	10	26	6	26	11	28	11¾	25	1¾
5	Slag "	24	1	26		21	5	26	4	26	11	29	1½	25	10½
6	No phosphate "	22	7	21		20	2	23	15	22	5	29	5	23	2⅓
7	Superphosphate {organic manure and sulphate of ammonia}	29	7	27		19	11	29	2	25	2	28	0¾	26	7
8	Do. 80 lb. sulphate of ammonia	27	4	27		23	0	29	8	28	14	23	14¼	26	10
9	Do. 60 lb. "	27	11	27		22	8	28	5	29	0	26	7	26	15
10	Do. 40 lb. "	26	6	25		20	2	26	16	27	8	23	8½	24	16¾

question as to the advantage of having it entirely soluble are the two to which dung was applied, and it is probable that the differences noticed in these two cases may be due to inequalities in the spreading of the dung. This is evidently the case in the Ormiston experiment, where the field was dunged in autumn before the site of the experiment was chosen.

4. The plot which received $1\frac{1}{2}$ lb. of sulphate of ammonia to 17 lb. of superphosphate is the best of the three plots 8, 9, and 10, showing that it is not profitable to apply more than 1 part of ammonia to 14 parts phosphate of lime, and that even a less proportion of ammonia might be more economical.

These are the answers to the questions proposed that are supplied by the experiments of the Border Union farmers. It must be observed, however, that as regards phosphates there was no great want in these soils, for plot 6, which got no phosphate, is not very far behind the others; or, what is more probable, the artificial manures, owing to the dryness of the season, were not permitted to show their effects so manifestly as in ordinary circumstances they would have done.

VALE OF ALFORD ASSOCIATION.

We may now examine the results obtained in the Vale of Alford, and see how far they bear out the results of the Border experiments. Seven of the trials made there were regarded by the local committee as worthy of being recorded—viz., those of

Mr GEORGE BARRON, Meikle Endovie.
Mr J. W. BENTON, Cattie.
Mr JOSEPH BROWN, Little Endovie.
Mr JAMES CRAN, Knockandoch.
Mr CHARLES MACINTOSH, Cairnballoch.
Mr ALEXANDER WALKER, Mill of Fowlis.
Mr WILLIAM YOOL, Glenloggie.

On most of these farms dung was applied to the experimental plots. It is unnecessary here to discuss the results obtained in each case. They are shown on Table III., and the average results are shown in the last column of the table.

It will be seen that as a whole they entirely confirm the experiments on the Borders, but in this district the manures have had a more marked effect upon the crop. This is made evident by the very small crop grown upon plot 6, which had no phosphate applied to it. The soils in that granite district are of a lighter character than those on the Border farms; but despite the lightness of the soil and the more porous character of the subsoil, the soluble phosphates and the soluble nitrogenous manure have had most effect in increasing the turnip

TABLE III.—EXPERIMENT II. VALE OF ALFORD ASSOCIATION.

	Farm	MEIKLE ENDOVIE.		CATHIE.		LITTLE ENDOVIE.		KNOCK-ANDOCH.		CAIRN-BALLOCH.		MILL OF FOWLIS.		GLEN-LOGGIE.			
	Soil	Black loam		Sandy loam		Light loam		Loam, porous subsoil		Loam, porous subsoil		Poor moorland		Black loam, porous sub-soil			
	General manure . . .	Dung		Bone-meal and dung		None		Dung		Dung		Dung		None		Average	
	Per acre—	tons.	cwt.	tons	cwt.	tons.	cwt.	tons.	cwt.	tons.	cwt.	tons.	cwt.	tons.	cwt.	tons.	cwt.
1	Bone-meal organic manure	21	1	20	3½	21	12¾	13	15	20	11½	26	13	25	3	21	5¾
2	Vitriolated bones ”	20	15½	19	12½	21	12¾	16	5	20	17	23	19¾	30	0	21	17½
3	Ground phosphate ”	18	10¾	17	1	17	10	14	7	24	8½	20	6¾	26	1½	19	18
4	Superphosphate ”	22	16	16	12¼	22	1½	12	1½	24	5¾	29	9	28	18½	22	6½
5	Slag ”	19	17½	15	9½	21	1½	16	10	25	2¾	30	19¼	28	11½	22	10¼
6	No phosphate ”	18	13	15	7	9	0	14	7	17	11½	9	0¾	25	0	15	11¼
7	Superphosphate { organic manure and sulphate of ammonia }	20	12	15	13	22	18½	15	7	24	8½	25	16	29	7	22	0¼
8	Do. { 80 lb. sulphate of ammonia }	21	6¾	12	3	23	2	18	8	24	5¾	29	15	28	18½	22	11¼
9	Do. 60 lb. ”	23	10¾	12	1½	23	10	18	18	25	5¾	29	3	27	8½	22	16¾
10	Do. 40 lb. ”	21	16½	14	14½	23	18½	18	0	25	8½	26	2	27	0	22	8½

crop. In this district, however, it would seem that 40 lb. per acre of sulphate of ammonia is a sufficient quantity to apply to turnips, and that by doubling the amount no advantage is gained, at least during a dry season. Altogether the nitrogenous manures applied have not given a good return. It is the phosphatic constituent of the manure that has been most effective, and in this respect the Vale of Alford experiments and those on the Border are in marked contrast.

The Secretary, Mr Charles M'Connach, Cairnballoch, who, along with another member of the committee, visited the farms of the experimenters and examined the plots, informs me that while the various plots showed very instructive differences, the total amount of the crop, owing to the extremely dry weather, fell far short of an average in some cases, and especially at Knockandoch.

BERWICKSHIRE AGRICULTURAL ASSOCIATION.

The late-sown turnips were a very unsatisfactory crop in Berwickshire last year. Owing to the drought in June they brairded very unequally, and as it was to the late-sown turnips that the manures were applied, they suffered very much. It was found, however, that the experiment conducted by Mr H. Hewat Craw, West Mains of Foulden, had not been affected by the drought to such an extent as to interfere with the brairding, and as it had been put in under most favourable conditions, and showed the effects of the manures most accurately, the committee considered it quite reliable, and published the results among the members of the association.

The soil is a weak mossy loam, with a sandy subsoil, on the old red sandstone formation. No dung was applied, but the field received 3 cwts. of kainit per acre in February. The crop was Fosterton Hybrid, sown 13th June, singled 17th July, and lifted 13th December.

The following are the results in tons per acre:—

Plot.		Tons.
1.	Fine bone-meal	18½
2.	Vitriolated bones and organic manure	26
3.	Ground phosphate "	16½
4.	Superphosphate "	29
5.	Thomas-slag "	23
6.	Organic manure alone	15½
7.	Superphosphate, organic manure, and ammonia sulphate	27½
8.	Superphosphate and 80 lb. ammonia sulphate	27½
9.	Do. 60 " " "	29½
10.	Do. 40 " " "	30
11.	Nothing	16
12.	Nothing	15½

It is evident that on this land soluble manures are most appropriate. With perfect regularity the produce is in direct proportion to the solubility of the phosphate—viz.:—

	Tons.
Superphosphate	29
Dissolved bones	26
Thomas-slag	23
Fine bone-meal	18½
Ground phosphate	16½

This is the kind of response which is given to an experimental inquiry when carried out with perfect accuracy on uniform soil, without dung, under favourable conditions. No less reliable are the results got on the other plots. The want of phosphate on plot 6 prevented the nitrogenous manure from doing any good to the crop, while plots 7, 8, 9, and 10 bear out what was noticed in the experiments elsewhere—viz., that it is a mistake to apply more nitrogenous manure of an active kind to the turnip crop than is represented by about half a cwt. sulphate of ammonia per acre. Although the returns of the Berwickshire Agricultural Association as regards Experiment II. are limited to this one instance, the care bestowed upon it and the success accompanying it have brought out results which yield reliable information for all the members who are farming similar land. Accurate notes were taken every month by Mr Craw, showing the relative position of all the plots, both as regards roots and tops. Such notes are frequently of great use in enabling a farmer to interpret aright the final results of the experiment. It is evident from the notes taken in this case that the effect of the soluble manures was to enable the roots of the turnips to force their way more rapidly down to the lower parts of the soil, and make them more independent of the drought. It may be asked why, if that were the case, the crops on plots 8, 9, and 10 do not show a superiority directly in proportion to the amount of soluble nitrogenous manure applied to them, for it is seen that the plot which received the smallest amount of sulphate of ammonia is the best. The interpretation of that result given by Mr Hart, in discussing the results obtained in the large number of experiments made in Kincardineshire, to which I shall refer immediately, appears to me to be the correct one—viz., that the over-dose of active nitrogenous manure caused the plants to be forced away too rapidly, with the result that their tissues were not so well matured, and despite their rapid start they were not so robust as those which got what seems to be the most appropriate proportion of soluble nitrogenous matter—that is to say, a manure showing an analysis of about one part of ammonia to fourteen parts of phosphate of lime.

STRATHBOGIE FARMERS' CLUB.

The secretary of this club, Mr Andrew Cruickshank, Huntly, informs me that the prevalence of drought interfered very much with the experiments in that part of the country, and the local committee considered that only two were so circumstanced as to produce results that could be relied on—viz., those of Mr William Scott, Corsiestone, and Mr John Duncan, Dowmin. These were as follows per acre:—

Plot.	Manures.	Corsiestone.		Dowmin.	
		tons.	cwt.	tons.	cwt.
1	Fine bone-meal	25	11½	28	15
2	Vitriolated bones and organic manure .	26	14¼	27	18½
3	Ground phosphate " . .	25	18½	26	14¼
4	Superphosphate " . .	24	5¾	27	19¼
5	Thomas-slag " . .	25	14¼	27	15¾
6	Organic manure alone	23	14¼	27	5
7	Superphosphate, organic manure, and sulphate of ammonia	27	14¼	28	16½
8	Superphosphate and 80 lb. sulphate of ammonia	26	8½	28	15
9	Superphosphate and 60 lb. sulphate of ammonia	28	...	29	14¼
10	Superphosphate and 40 lb. sulphate of ammonia	30	14¼	30	6½
11	Dung alone	25	14¼	24	18½
12	Nothing	...	...	17	17

The soil at Corsiestone was a light dry soil on a granitic subsoil, that at Dowmin was a dark dry loam of good quality, and both were dunged in the drills.

The effect of applying dung has naturally been to swamp to some extent the distinctions due to the application of the light manures, and the phosphates can scarcely be said to have materially contributed to the growth. With the sulphate of ammonia the case is different. It has increased the crop in both cases, and here again, as in the case of the experiments made elsewhere, the smaller application of that manure has been most favourable to the growth.

To show how this peculiarity has arrested the attention of the farmers who have tried this experiment, I cannot do better than quote the remarks of Mr Scott, Corsiestone, in a lecture on the experiments delivered to the Strathbogie Farmers' Club on 26th February:—

> "Plots 8, 9, and 10 are the ones that took my attention most in the whole experiment. Just at first they were much the same, but soon 8 took the lead, and looked best, 9 next, and 10 the worst of the three, for the first half of the season, but by the 1st of October it was doubtful which was best, and by the end it became pretty clear they would turn out just the very opposite of what they looked at first. You will observe these three plots got all the same amount of superphosphate, but 9 got only three-quarters the amount of ammonia of 8, whilst 10 got only one-half the ammonia, and the weight of turnips on each was 26 tons 8 cwt., 28 tons, and 30 tons 14 cwt. respectively. That is, plot 10, with same phosphate and only one-half ammonia as plot 8, yielded a crop of 4 tons 6 cwt. more turnips, showing very distinctly that it is quite possible to use ammonia to no purpose, and that it may even be detrimental to a crop of turnips: Mr Duncan's experiments most thoroughly agree with mine in this matter. The use of too much ammonia seems to go to produce a large proportion of leaf rather than to increase the size and weight of the bulb, which is of most value. When both the tops and bulbs are to be eaten—and more especially if done early in the season—it might probably be wise to use somewhat more ammonia than is required to grow the heaviest crop of bulbs. But I consider it is quite easy to use a too high-priced turnip manure, the efficiency not being in proportion to the price. When ammonia is used, it should be done sparingly, especially when used along with rich farmyard manure, when we have not only a great saving in our manure account, but may often expect a decided improvement in the turnip crop."

Fine bone-meal has done better at Dowmin than at other places. Were it not that the experiment was most carefully carried out, we should be inclined to suppose that plot 1 had received a little more than its proper share of farmyard manure; but it is evident that on the fine dry loam of that field, the conditions were very favourable to the activity of fine bone-meal. Mr Scott mentions in his report that the plots made much growth in October and November, owing to the favourable weather at that season, and that during that time plot 11 greatly improved its position. He also mentions an interesting fact that an adjacent plot manured and sown twenty-one days earlier produced a crop of 37¾ tons per acre, thus showing how all-important for the growth of the turnip crop is the occurrence of fine moist growing weather during the young and critical period of the plant's growth.

KINCARDINESHIRE FARMERS' CLUB.

The experiments made by a large number of Kincardineshire farmers, with an amount of zeal which redounds greatly to their credit, are described in another part of this volume by Mr Hart, under whose organisation and guidance they were carried out. These experiments are so numerous, and the work has been so thoroughly done, that complete reliance may be placed on the accuracy of the general results obtained; and corroborating as they do the results of experiments of the same kind in other parts of the country, they may be justly considered to have solved, so far as that is possible in one season, the problems proposed in the experiments. For an account of the manner in which the work was done, the circumstances of each experiment, and the benefit to be derived from such co-operative investigations, I must refer the reader to Mr Hart's paper; but having carefully studied the abundant materials which he has provided, I gladly take the opportunity to summarise them, and point out some of the conclusions to which they lead.

Almost all these experiments were made upon land manured with farmyard manure at the time of sowing. As has already been pointed out, it is inevitable in such circumstances that in some cases the unequal spreading of the dung, and in others the inequalities of the soil, must disturb the accuracy of the experiment; but when any material disturbance of that kind has occurred, it is easy by a comparison of the various plots which form a check upon each other to discover where the discrepancies are. If they are such as to materially affect the accuracy of the investigation, the experiment must be set aside. In the subjoined summary I have included only those experiments which were made on equal land evenly manured, and which were unaffected by "finger and toe," or other disqualifying circumstances. The experiments were performed upon a great variety of soils, which are described in Mr Hart's paper, and in Table IV. I have roughly divided them into lighter soils and heavier ones, and expressed the results in whole numbers of cwts. per acre.

We may now inquire how the four questions asked in the investigation have been answered by the Kincardineshire experiments.

1. *Should the phosphates in a turnip manure be soluble or insoluble?*

It will be seen that the lighter soils have borne the larger crops, but it is further noticed that while the insoluble phosphates have not done so well as the soluble ones, it is chiefly on the heavier class of soils that their deficiency is observed. The general conclusion to be drawn from that is, that if insoluble phosphates are to be used for the turnip crop, it should be only on the lighter class of soils. It is evident that on light soils the conditions are more favourable for the rotting or dissolving of insoluble phosphates. On heavy soils, on the other hand,

TABLE IV.—EXPERIMENT II. KINCARDINESHIRE FARMERS' ASSOCIATION.

Plot.	MANURES.	LIGHT SOILS.											HEAVY SOILS.						
		Green.	Newton.	Kirkton.	Easter Muchalls.	Wester Logie.	Auquhirie.	Leithfield.	Powburn.	Mains of Mondynes.	Pitdrichie.	Average.	Upper Mills.	Logie.	Townhead.	Swine-waird.	East Mathers.	Haddo.	Average.
	Per acre—	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.
1	Fine bone-meal . .	354	304	398	400	426	197	512	498	610	311	401	397	360	351	488	237	221	342
2	Vitriolated bones and organic manure	459	345	446	560	534	228	613	520	597	391	469	441	480	377	528	258	273	393
3	Ground phosphate "	396	316	434	520	480	168	533	505	576	349	427	361	400	363	543	236	233	356
4	Superphosphate "	455	293	406	560	508	209	580	544	571	355	448	437	468	375	580	294	232	398
5	Thomas-slag "	408	299	406	600	470	240	595	560	581	262	442	421	530	407	480	337	240	403
6	Organic manure alone .	293	181	383	360	400	105	499	507	567	305	360	346	320	383	420	240	192	317
7	Superphosphate and organic manure and sulphate of ammonia	483	374	438	440	490	223	564	496	593	405	450	456	480	392	517	278	275	399
8	Do. and 80 lb. sulphate of ammonia	468	367	445	480	567	163	540	550	643	366	459	452	468	428	600	283	285	419
9	Do. and 60 lb. "	433	338	406	480	490	191	588	535	568	368	440	442	530	378	600	346	306	434
10	Do. and 40 lb. "	436	283	434	360	414	238	586	501	560	323	413	421	360	395	486	354	260	379

insoluble phosphates become, as it were, locked up, while soluble ones are able to spread or soak through the soil, and thus offer a larger surface for their absorption by the roots of the crop.

2. *Should the phosphates consist of bone, mineral phosphate, or Thomas-slag?*

It is evident from the results on plots 2 and 4, that so long as they are dissolved it does not matter from what source they are derived; but plot 3 informs us that mineral phosphate, if very finely ground, is fully as good as bone-meal, so long as a nitrogenous manure is supplied along with it in equal quantity to that contained in bones.

As regards Thomas-slag, it has quite maintained the character which it was seen to possess the previous year, when it was found to be quite equal to, if not better than, superphosphate, besides being much cheaper. Although it is insoluble in water, yet it is much more soluble than mineral phosphate when exposed to the solvent action of the soil.

3. *Should the nitrogenous manure be soluble or insoluble, or a mixture of these?*

On the whole, it is seen that the soluble nitrogenous manure has done best, especially on the heavier class of soils, so that it is evident that the manures applied to heavy soils should be as soluble as possible, both as regards phosphatic and nitrogenous manures. On the lighter soils a mixture of both, as seen on plots 2 and 7, is preferable. It is probable that, if the season had been a wet one, the advantage of having part of the nitrogenous manure of an insoluble kind in the lighter soils would have been still more apparent. We must read these results in the light of the circumstances in which they were made, and keep in view that they were obtained in a dry season.

4. *What proportion should the phosphates bear to the nitrogen?*

The plots which answer that question are Nos. 8, 9, and 10, where sulphate of ammonia was applied in various quantities along with a uniform amount of superphosphate. The answer we get on these plots refers, therefore, to soluble nitrogenous manure. On the lighter soils the largest application has on the whole done best, yielding on an average about one ton more roots than plot 9, which is a good return for its extra 20 lb. of sulphate of ammonia. On the heavier soils 60 lb. of sulphate of ammonia has produced on an average a better crop than 80 lb., and this is corroborated by the results obtained in other parts of the country. The answer to the question proposed is, that about half a cwt. of sulphate of ammonia to 6 cwts. of superphosphate is the most favourable proportion; or, in other words, a turnip manure should contain in most cases one part of ammonia to fourteen parts phosphate of lime.

EXPERIMENT III.

Thomas-slag versus *Superphosphate.* *Winter* versus *Summer Manuring.*

The objects of this experiment are—

1. To discover how Thomas-slag compares with superphosphate as a manure for turnips.
2. To discover how much the Thomas-slag is increased in its efficacy by being very finely ground.
3. To discover whether it is more advantageous to apply these phosphates in winter or in summer.

The following were the kinds, quantities, and cost of the manures:—

Plot.	Manures.	Quantity per $\frac{1}{20}$ acre.	Quantity per acre.	Cost per acre.	
		lb.	cwt.	*s.*	*d*
1 and 5	Thomas-slag of ordinary fineness —viz., 80 per cent passing through No. 100 wire-cloth	40	7	10	6
2 and 6	Thomas-slag very finely ground —viz., 80 per cent passing through No. 150 wire-cloth	34	6	10	6
3 and 7	Superphosphate, 26 per cent soluble phosphate	28	5	10	6
4 and 8	No phosphate	...	...	...	

The winter manures were simply spread over the surface of the land and left there. The summer manures were applied in a similar manner a few days before the field was made for turnips, so that the only difference in the treatment of the two sets of manure was in the time of their application. As regards the nitrogenous manure for this experiment, it was supplied as nitrate of soda, but the nitrate was not applied until the seed was being put in. Where farmyard manure was applied, no other nitrogenous manure was used.

The experiments made by various clubs during the former season showed that in most cases superphosphate and Thomas-slag were the best and most economical kinds of phosphate for a turnip manure, and it was considered desirable that they should be tried against each other, not as formerly on the basis of equal amounts of phosphoric acid per acre, but on what was considered the more practical basis of equal money value per acre. Moreover, as the efficacy of phosphates is known to increase in proportion to the fineness to which they are ground, it was deemed advisable to discover whether it would pay to have the slag ground down to a finer powder than that usually supplied. It was also considered to be a matter of practical importance to discover whether these phosphates lost any of their potency by being spread upon the land some months before sowing the turnip crop; for if they did not, it is evident that by applying them at any convenient time during the winter, the pressure of labour at the time of turnip sowing would be much relieved. In order to put the matter to a somewhat severe test, the winter-spread manures were applied five or six months before the time of sowing. The experiment was carried out in the Border district and in Kincardineshire.

BORDER UNION FARMERS' CLUB.

Two sets of results were sent in by the Club—viz., those of Mr John Fulton, Hatchednize, and of Mr George Henderson, Shidlaw. They were as follows:—

Plot.		Manures.		Hatchednize.		Shidlaw.	
			Cwt. per acre.	tons.	cwt.	tons.	cwt.
Winter.	1	Slag	7	25	1	28	15¾
	2	Slag, fine	6	24	19	22	10
	3	Superphosphate	5	23	9	27	14¼
	4	No phosphate	. . . .	24	3	22	17
Summer.	5	Slag	7	29	2	26	2¾
	6	Slag, fine	6	27	11	25	0
	7	Superphosphate	5	30	0	25	8½
	8	No phosphate	. . . .	24	3	22	14¼

The soils were light loam in both cases, and the former was dunged in the drills, but the latter got no dung. On both farms the phosphates were spread in January and at the time of sowing, and the soils were light loam.

They both agree in showing that any advantage that may arise from having the slag ground to greater fineness is more than compensated by the greater cost of the manure, and that

7 cwts. per acre of the ordinary slag is better than 6 cwts. of the finer variety. In some other respects the results are discordant; the winter application has done best at Shidlaw, and the summer application has done best at Hatchednize. In both cases the winter-spread slag has done better than the superphosphate; but on comparing the plots it is seen that there are slight irregularities, especially at Hatchednize, where they are probably due to the unequal spreading of the farmyard manure. The winter superphosphate plot at Hatchednize should not have produced less than the no-phosphate plot. Mr Henderson considers, as the lesson taught by his experiment, that he has no reason to fear loss from the early application of phosphates.

BERWICKSHIRE AGRICULTURAL ASSOCIATION.

This experiment was also tried on several farms in Berwickshire, and the results of these are reported, viz.:—

Mr Adam S. Logan, Ferney Castle.
Mr Hilton Middleton, Kimmerghame.
Mr Gilbert T. Millican, Harelaw.

The following are the results:—

EXPERIMENT III. BERWICKSHIRE AGRICULTURAL ASSOCIATION.

Plot.	Manures.	Ferney Castle.		Kimmerghame Mains.		Harelaw.	
	Applied in winter.	tons.	cwt.	tons.	cwt.	tons.	cwt.
1	Thomas-slag . .	12	5	23	0	23	0
2	Extra-fine do. . .	11	4	26	4	20	9
3	Superphosphate .	13	6	23	17	19	15
4	No phosphate . .	...	...	...	...	...	...
	Total crop	36	15	73	1	63	4
	Applied in summer.						
5	Thomas-slag . .	11	4	24	14	28	4
6	Extra-fine do. . .	10	10	24	16	25	19
7	Superphosphate .	13	12	25	4	25	15
8	No phosphate . .	...	...	...	...	...	...
	Total crop	35	6	74	14	79	18

The first is on thin clay, the second on strong clay, and the third on a moory loam. Dung was applied along with the phosphates at Ferney Castle and Kimmerghame, but not at Harelaw. These results support the conclusion already formed; but as regards the winter manuring, there is again a difference. On the first two the winter-spread manure did as well as the others, but at Harelaw the manure applied in the drills did very much better. These two sets of experiments have not given any definite answer to the question, and we must therefore wait for a repetition of the inquiry in these districts.

Fortunately, however, we owe to the enterprise of the Kincardineshire farmers much additional information on this subject. The experiment was tried on a large number of farms upon soils which had been dunged in the drills. As in the case of Experiment II., I have divided the results into those obtained on lighter and heavier soils, with the hope of obtaining additional information of practical use. They are given in Table V.

In these experiments it is seen that the finer-ground slag gave a slightly better result, but the advantage of finer grinding is not so great as to make it desirable to obtain a finer product than that which is already supplied—viz., 80 per cent passing through No. 100 wire-cloth.

On the lighter soils the slag has done better than the superphosphate, both in the summer and winter application; but on the heavier soils the superphosphate has been most efficacious.

The most notable result, however, is that it is quite as advantageous to apply these manures in winter as at the time of sowing. Had the phosphates been put on in March instead of in January, the results would probably have been more decidedly in favour of the early application; but we may accept it as a very important fact, that it is quite unnecessary to delay the application of phosphatic manures until the time of sowing, if it is found to be more convenient to apply them at an earlier date.

EXPERIMENT IV.

Bone-meal versus *Steamed Bone-flour.* *Winter* versus *Summer Manuring.*

The objects of this experiment are—

1. To discover whether fine bone-meal or steamed bone-flour is the more profitable manure for turnips.
2. To discover how these compare with superphosphate.
3. To discover whether it is more advantageous to apply them in winter or in summer.

TABLE V.—EXPERIMENT III. KINCARDINESHIRE FARMERS' ASSOCIATION.

Plot.	MANURES.	LIGHT SOILS.										HEAVY SOILS.						
		Wester Logie.	Mains of Raemoir.	Mains of Dunnottar.	Nether Criggie.	Crossgates.	E. Mains of Barras.	Slains.	W. New-tonleys.	Kernoon.	Average.	Westport.	Mains of Findon.	Craighead.	Logie.	Easterside.	Lumgair.	Average.
	Applied in winter.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.
1	Thomas-slag	397	...	355	420	410	400	506	414	299	400	433	526	534	440	377	267	428
2	Do. very finely ground	400	468	340	381	384	431	518	433	326	409	364	520	547	420	400	312	427
3	Superphosphate . .	363	398	338	397	374	386	387	411	282	371	408	514	554	428	343	315	427
4	No phosphate	...	364	...	337	346	423	344	436	303	365	420	543	454	377	297	238	388
	Total average crops . .	...	...	...	...	...	..	...	...	...	1545	...	...	...	..	...	...	1670
	Applied in summer.																	
5	Thomas-slag	403	403	328	393	430	468	516	360	368	408	457	600	527	320	406	326	439
6	Do. very finely ground	417	404	325	387	443	463	578	368	348	415	459	554	530	440	497	336	469
7	Superphosphate . . .	396	434	277	381	420	391	430	369	331	381	474	623	527	380	366	339	451
8	No phosphate	394	390	261	328	366	423	380	.	339	360	435	497	408	378	348	318	397
	Total average crops . .	...	...	...	..	...	...	...	..	...	1564	...	...	...	..	...	...	1756

TABLE VI.—EXPERIMENT IV. KINCARDINESHIRE FARMERS' ASSOCIATION.

Plot.	MANURES.	LIGHT SOILS.											HEAVY SOILS.							
		Wester Logie.	Mains of Raemoir.	Dunnottar Mains.	Nether Criggie.	Crossgates.	E. Mains of Barras.	Slains.	W. Newtonleys.	Newtonleys.	Kernoon.	Average.	Westport.	Causeyport.	Mains of Findon.	Craighead.	Bishopston.	Logie.	Easterside.	Average.
	Applied in winter.	cwt	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt	cwt.	cwt.	cwt.	cwt.
1	Fine bone-meal .	437	329	408	411	410	508	488	411	520	320	424	...	517	463	476	434	377	400	444
2	Steamed bone-flour and meat-meal	423	388	416	370	410	526	487	434	541	294	429	323	...	566	504	470	400	391	443
3	Superphosphate and meat-meal	443	456	378	370	452	540	431	358	550	294	427	363	520	560	611	546	400	386	484
4	Meat-meal alone .	...	350	353	376	361	486	378	321	...	290	364	...	343	486	408	...	400	334	394
	Total average crops	...	...	...	...	...	...	...	...	...	...	1644	...	...	...	...	...	...	...	1765
	Applied in summer.																			
	Fine bone-meal .	403	...	328	377	405	411	513	482	570	320	423	412	514	434	544	428	377	400	444
6	Steamed bone-flour and meat-meal	383	352	325	406	441	526	493	513	580	365	438	414	528	531	477	426	463	451	470
7	Superphosphate and meat-meal	420	367	277	443	481	540	454	437	552	370	434	468	580	560	567	433	442	463	502
8	Meat-meal alone .	..	296	261	403	441	454	350	363	541	266	375	310	370	463	448	...	360	391	390
	Total average crops	...	..	...	...	...	...	...	...	...	...	1670	...	...	...	...	...	...	...	1806

The following are the kinds, quantities, and cost of the manures:—

Plots.	Manures.	Cost per acre.
1 and 5.	Bone-meal—80 per cent passing through ⅛-inch sieve, 50 per cent phosphate, 4½ per cent ammonia	25s.
2 and 6.	Steamed bone-flour and meat-meal—50 per cent phosphate, 4½ per cent ammonia . .	25s.
3 and 7.	Superphosphate—26 per cent soluble phosphate and meat-meal	25s.
4 and 8.	No phosphate, but meal as in 3 and 7 . .	...

This experiment is somewhat similar to Experiment III. The manures were applied at the cost of 25s. per acre. The results speak for themselves (see Table VI.). On the lighter class of soils all the phosphates are about equal, and it seems quite immaterial whether they are applied in winter or at the seed-time. On the heavier soil the soluble phosphate is again the most productive, and here again there is no great difference in the amounts of crop yielded by the early and late-sown manures.

BOTHWELL FARMERS' CLUB.

EXPERIMENTS ON BEAN, HAY, AND OAT CROPS.

The members of the Bothwell Farmers' Club expressed a desire to have some experiments made on the manuring of beans, hay, and oats. Accordingly the following were drawn up, and schedules supplied to the members.

Bean Crop.

The Society's experiments at Pumpherston had shown the great importance of potash as an ingredient in bean manures, and also the usefulness of superphosphate and gypsum, so that it was resolved to give these a trial. Moreover, as nitrogenous manures had done no good at Pumpherston they were left out, and it was thought expedient to try the effect of common salt, not so much for its own sake as for its indirect action in enabling the crop to take up its potash more easily. It is the universal practice to apply dung to the bean break, and usually in very considerable quantity; but as the Pumpherston experiments showed that dung was unnecessary to grow a crop of beans, it was resolved to try the manures both with and without dung.

The experiment was put down with great care at Parkhead, and the following are the results:—

BEANS, 1889.

					A		B	
	Manures Applied per Acre.				Without Dung.		20 Tons Dung per Acre, and Half Quantity of Artificials.	
	Super-phosphate.	Sulphate of Potash.	Gypsum.	Common Salts.	Beans.	Straw.	Beans.	Straw.
	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt	cwt.
1	4	4	4	2	20¼	28½	25¾	28
2	6	4	4	2	23	26¼	27¼	29½
3	4	6	4	2	18¼	23	24¼	27¼
4	4	4	6	2	22½	26¾	26¼	27½
5	4	4	...	2	22½	25¾	22	25¼
6	4	4	...	..	29	30	26	30¾
7	...	...	...	...	15	24	17	26¼

From a single experiment it is unsafe to draw general conclusions, but the results of this little experiment are so much in accordance with those obtained at Pumpherston that we need not hesitate to accept the lessons it teaches in a general way.

In the first place, it shows how inappropriate dung is as a manure for beans. The totally unmanured plot (A 7) produced 15 cwts. grain per acre, while that which got 20 tons farmyard manure (B 7) raised only 2 cwts. more.

The best plot in the series is A 6, which got nothing but superphosphate and sulphate of potash. By the application of these two manures the crop has been nearly doubled. It may be that this plot is better than it ought to be, and it would have been very satisfactory if it had been corroborated by other experiments in the district, but there is good reason to suppose that it is quite reliable. The plot next to it (plot 5) has produced much less, but that may easily be due to the injurious action of the common salt. This substance seems to have done no good but only harm, especially on the A section. It was thought that as the district is pretty far removed from the sea, the application of salt might be advantageous; but it is evidently quite otherwise, at least as regards the wants of a bean crop. It seems as if the common salt had levelled down the fertility plots to which it was applied, and shorn them of much of their interest.

The dunged plots are, on the whole, better than the undunged, but it may be that they owe their superiority partly to the fact that only a half-dose of salt was applied to them. Plot 3 shows that the application of sulphate of potash, useful as it is, can be over done; and the whole experiment teaches that a good crop of beans can be grown with the application of superphosphate and sulphate of potash, without the use of farmyard manure. This is a fact worth knowing in a district where dung is much required for the manuring of grass and potatoes.

Another object of this experiment was to discover what was the most profitable time at which to cut a bean crop, so as to obtain the greatest amount of nutritive fodder. For this purpose, samples of the crop were cut at three different stages of growth.

1. When the flower had just gone off, and the pods formed at the apex.
2. When in full growth and the pods filled.
3. When ripe.

When the first cutting was made, the pods at the lower part of the stem were fairly well filled with unripe seed, and the weight of the straw was almost double that of the grain.

On the occasion of the second cutting, the lower pods were filled with ripe seed, the upper ones with immature seed, and the weight of straw was one-fourth more than the grain. When the crop was ripe, the grain weighed more than the straw.

ANALYSIS OF BEAN CROP CUT AT DIFFERENT STAGES OF GROWTH (dry).

	True Albumen.	Amides, &c.	Oil.	Carbo-hydrates.	Woody fibre.	Ash.	Proportion of beans to straw.
First stage—	%	%	%	%	%	%	%
Grain . . .	28.3	3.7	2.4	56.1	5.5	3.9	35.1
Straw . .	10.9	1.1	.5	54.6	25.1	7.8	64.9
Total plants	16.9	2.0	1.15	55.1	18.4	6.5	...
Second stage—							
Grain . . .	27.7	2.9	3.4	57.6	5.1	3.4	40.6
Straw . .	8.7	.9	.7	57.4	24.2	8.1	50.4
Total plants	18.1	1.9	2.0	57.4	14.8	5.8	...
Third stage—							
Grain . . .	28.6	3.4	3.8	55.8	4.6	3.7	51.1
Straw . .	6.3	.9	.9	56.1	28.8	7.0	48.9
Total plants	17.6	2.2	2.39	56.0	16.5	5.3	...

It is seen from these analyses that the chief change that has occurred in the grain during the first and third periods is a very considerable increase in the amount of oil; and as that is a constituent in which beans are somewhat deficient in comparison with other concentrated fodders, it is an important item. As regards the straw, the chief change that has taken place in it is a very rapid diminution in the amount of albumen. At the third stage it contained not much more than half the amount of that valuable constituent. It had gone to form the grain, and been stored up there. The diminution in albumen is accompanied by an increase in the amount of woody fibre; but when the relative proportions of grain and straw are taken into account, and the total amount of nutritive matter contained in the whole plant is determined, it is seen that there is very little difference in the composition of the total crop except as regards oil, in the two periods between the first and third stages of growth.

It would seem, therefore, that the most profitable time to cut the bean crop is to be determined, not by the composition, but by the bulk of the crop, and that is therefore at the time of ripeness. There is no advantage to be got from the early cutting of a bean crop.

HAY CROP EXPERIMENTS.

It is the custom of those in the district who top-dress their hay to apply somewhat less than 1 cwt. per acre of nitrate of soda. The fields intended for hay are usually manured in autumn with farmyard manure, or with police manure, which is readily available. The object of the experiment was to see if the top-dressing of grass intended for hay in this manner was profitable, and whether superphosphate and potash salt might not be advantageously applied along with the nitrate. This is not a question to be settled by experiments made in one season, nor with reference to the hay crop alone, especially when, as in this case, the phosphate and potash salts were applied as a top-dressing in the spring. So far as the effects of these latter substances are concerned, and especially the potash, it would form a more instructive experiment if they were applied in the autumn, so that they should have a better chance of exerting their influence upon the crops. This is a further development of the experiment, which may be tried at another time; but it was thought a useful thing to try, in the first place, the spring application.

The quantities of manure and the hay crop secured are given on next page.

BOTHWELL FARMERS' CLUB, 1889. HAY EXPERIMENT.

	MANURE APPLIED PER ACRE.				HATTON-RIGG.	UN-THANK.	SUNNY-SIDE.	SUNNY-SIDE.	AVERAGE.
	Nitrate of Soda.	Common Salt.	Sulphate of Potash.	Super-phosphate.					
	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	
1	¾	...	...	...	63¼	49¼	45¾	45	51
2	¾	1	..	...	62¾	49	45¾	43¼	50
3	¾	...	1	...	63½	47½	42½	44	49
4	¾	...	...	2	56½	45	47½	46¾	49
5	¾	...	1	2	64	48¼	49¼	47¾	52
6	...	...	...	...	57	36	45¼	39¼	44
7	⅜	1	...	...	61	45½	...	...	53

At Hattonrigg and Sunnyside the manures were applied to first year's hay, and at Unthank to second year's hay.

At Hattonrigg the aftermath was also secured and weighed, and it is instructive to notice how it compared with the first cutting, and what was the total amount of hay produced on the various plots.

Plot.		Cost of Manures.	After-math.	Total Hay.	Excess over Plot 6.
			cwt.	cwt.	cwt.
1	Nitrate	8/	24	87¼	1¼
2	Nitrate and common salt . .	10/	24¼	87	1
3	Nitrate and sulphate of potash	13/	25½	89	3
4	Nitrate and superphosphate .	14/	22¼	78¾	...
5	Nitrate, superphosphate, and sulphate of potash . .	19/	27¾	91¾	5¾
6	Nothing	...	29	86	...

If plot 6 may be taken as representing the unaided fertility of all the plots, it is evident that if we reckon both crop and aftermath, very little advantage has been derived from the top-dressing. Its effect has been to hasten forward the growth of hay, so that there was secured in the first cutting a part of what would otherwise have been found in the aftermath or used as pasture.

If we take into consideration the price of the manure, and set off against it the amount of hay produced in excess of that obtained in plot 6, it is evident that with hay at 50s. per ton there would be a net loss on all these plots. But we are not entitled to presume that plot 6 represents the fertility of the other plots, previous to their being top-dressed, for we find that plot 4, which received both nitrate of soda and superphosphate, has yielded a smaller crop than where no manure was applied. This anomaly is due either to inequality of soil, or still more probably to the unequal application of dung; and it would, therefore, be misleading to reckon the profit or loss from the application of the manures on that evidently erroneous assumption. This is an experiment that would require to be duplicated and repeated on successive seasons, and special care would be necessary to secure that the farmyard manure or other heavy applicants were spread over the plots with great evenness.

The experiment on Unthank is more intelligible. There the nothing plot is considerably behind the others, and if used as a basis for estimating the advantage accruing from the top-dressing, would show a considerable profit, especially on plots 1 and 2; but it would be a mistake to apply the figures too rigidly in such cases.

This can only be said to be the beginning of an experiment that should be carefully carried out for some years.

EIGHT-PLOT TEST.

The eight-plot test, for the purpose of discovering what manurial ingredient is most deficient in the soil, and therefore most required in the manure for the production of any particular crop, was tried for the oat crop on several farms, but as the results obtained are chiefly of interest to the experimenters themselves, it is unnecessary to give any special report of them.

PUMPHERSTON EXPERIMENTAL STATION.

REPORT ON GRASS EXPERIMENTS.

The grass crop at Pumpherston was sown out in the spring of 1887 along with barley. No manures were applied to the barley, nor yet to the preceding turnip crop, and no dung had been put on the land for twelve years.

The object of this somewhat severe treatment was to see what residue of fertility had been left in the land from the various manures that had been formerly applied. A full description of the results of the grass crop sown in these circumstances is to be found in last year's 'Transactions' (1889, pp. 227-246). It was evident from the variety of growth on the various plots that there was still a considerable amount of residual fertility to be worked out, and that the information to be derived from the station on that subject was still far from being ripe. It was therefore resolved to continue this part of the investigation, but it was considered that it would be sufficient if one-third part of the station were devoted to it. Accordingly each plot on the station was divided into three parts. To one part (section B) no manure was applied, to another (section A) the same kind of manuring was applied as in former years, and the remaining third (section C) was left to be treated in various ways which will be described hereafter.

By this arrangement the station has been divided into upwards of a hundred plots, most of which are one-twelfth part of an acre in extent.

It will be expedient to begin this report with the results of section B, which has not been manured for four years, and from which, during that time, there has been taken a crop of turnips in 1886, barley in 1887, grass made into silage in 1888, and hay in 1889. The results are shown in Table I. (p. 360), from which it is evident that the latent fertility derived from the manures applied during seven years previous to 1886 is fast disappearing. As the crop of 1888 was not made into hay, but cut green and put into the silo, the results of that year are given in cwts. per plot of fresh grass; but as the amount of moisture in the grass of each plot was determined, and the amounts of completely dried grass deduced therefrom, it is easy to calculate what would have been the weight of hay produced by each plot. This has been done on the assumption that the hay would contain about one-seventh of its weight of moisture, and the results are shown in round numbers in the second-last column of the table. In comparing the results of the two

PUMPHERSTON STATION.

TABLE I.—HAY CROP, 1889.—*Unmanured Section.*

No. of Plot.	MANURES APPLIED IN 1878, 1879, 1881, 1882, 1883, 1884, AND 1885. (No Manures applied in 1886, 1887, 1888, and 1889.)		Cwt. per Acre.	
			1888.	1889.
	Phosphatic Manures.			
5	Bone-meal	With nitrate of soda and potash salts.	27	24
6	Do. dissolved		28	27
7	Phosphatic guano		30	30
8	Do. do. dissolved		40	30
9	Ground mineral phosphates		21	27
10	Do. do. dissolved		31	27
11	No phosphates		22	27
12	Bone-ash alone		14	21
	Nitrogenous Manures.			
13	Nitrate of soda	With super-phosphate and potash salts.	26	27
14	Sulphate of ammonia		28	27
15	Horn-dust (shoddy 1878)		30	33
16	Dried blood		35	39
17	No nitrogen		26	30
18	Nitrate of soda alone		16	24
	Potassic Manures.			
19	Sulphate of potash	With superphosphate and nitrate of soda.	30	33
20	Muriate of potash		25	33
21	No potash		16	27
22	Potash salts alone		23	27
	Guanos.			
23	Peruvian-guano		22	30
24	Fish guano		35	33
25	Ichaboe guano		21	24
27	Unmanured continuously		9	14
	Superphosphates.			
28	10% Soluble phosphate	With sulphate of ammonia and potash salts.	31	24
29	25% do. do.		22	21
30	40% do. do.		32	30

years, it must be borne in mind that the hay of the first year's grass consisted largely of clover, which was present to only a trifling extent in the second year's grass on most of the plots, as will be described further on.

Very little comment is required on these results, as the figures are few and they speak for themselves. The most disappointing plot of the series is plot 5, to which bone-meal used to be applied. We should have expected that the effect of that manure would have been more permanent than the others, and for some years it did show signs of mending its position, but the improvement has not been maintained since the manuring was discontinued. On a light sandy loam the case might have been very different, but at Pumpherston the soil is a clayey loam resting upon boulder clay; and experiments in other parts of the country have shown that bone-meal and insoluble phosphates generally are the less efficacious the more tenacious is the soil. Plot 15 shows that the horn-dust applied in former years has left a considerable residue of fertility; and plot 16, which received its nitrogenous manure in the form of dried blood, is now the best plot on the unmanured section. By residual fertility is meant not only the unused residue of the actual manures applied in former years, but also the residue of roots and stubble left by the crops removed; so that plots which in former years produced large crops, and in so doing used up in larger proportion than others the manurial substances supplied to them, have been able to make more extensive use of the inherent fertility of the soil, and have brought up by their deeper roots a considerable amount of the manurial matter of the subsoil, and left it in their root residues as an available store of fertility for the crops of later years. As regards the guanos, the Ichaboe is inferior to the others, as it was the former year; and the fish guano, or rather fish-meal, is still the best of the set.

The third part of each plot which has been reserved for continuing the system of manuring adopted in former years is that which is adjacent to the middle walk, and as the numbers of the plots run alternately north and south, the effects produced by the application of manures closely related to each other admit of easy inspection and comparison. The manures applied to this part (section A) were sown under most favourable conditions on 16th April. The Chemical Committee inspected the station about three weeks thereafter, and recommended that manures similar to those on section A should be applied to section C, which consists of that third of each plot which lies at the north and south of the field, and which is separated from section A by the unmanured section B. The manures were put on section C on 18th May, and these plots are therefore duplicates of section A, with this difference, that the manures were applied a month later.

The manures applied on section A are precisely those applied in former years, except upon plots 7 and 8, which used to be manured with phosphatic guano. The supply of that kind of manure seems now to be exhausted. There was none to be had in 1889, and as I was informed that there was no prospect of its being imported, plot 7 was manured for the first time with steamed bone-flour, and plot 8 with Thomas-slag, a manure of which there is an abundant and unfailing supply. Experiments made with the slag in the two preceding years had shown it to be a valuable manure, and it was therefore desirable that its effects upon grass, of which various accounts were reported, should be tried at Pumpherston. In the meantime, plot 29, which had already served its purpose, had been set apart for the slag experiment, so that there are now two plots manured with that substance.

Phosphate, from whatever source, was applied in such quantities that each plot receiving it got 5 lb. of phosphoric acid. Potash manures were applied at the rate of 2½ lb. of potash per plot, and nitrogenous manures at the rate of 2½ lb. nitrogen per plot. Unless where otherwise specified, phosphoric acid was applied as superphosphate, containing about 27 per cent soluble phosphate—viz., 40½ lb. per plot; potash, as a mixture of sulphate and muriate, and derived equally from these two sources—viz., 4½ lb. sulphate, and 2 lb. muriate per plot; and nitrogen, as an equally balanced mixture of nitrate of soda and sulphate of ammonia—viz., 8 lb. of the former, and 6½ lb. of the latter. The season of 1889 was exceptionally favourable for grass, and there was a heavy crop over the county. Seasonable showers fell in April and May, and June was warm and dry. The hay was cut in beautiful weather on the 5th of July, put into coils on 9th, and weighed off the field in the most favourable circumstances on 27th July.

The kinds of manure applied, and the quantities of hay grown on these two sections, are shown in Table II.

It will be seen that with one or two exceptions the produce of the late-manured plots is less than the others. The deficiencies occasioned by the late application of the manures are not so great as might be expected, and it is worth while to examine the plots in detail, for they convey some useful information. The plots which derived least benefit from the late manuring are those to which insoluble manures were applied, notably the bone-meal plot (No. 5), and the ground mineral phosphate plot (No. 9). The slag phosphate plot was not so far behind, because, although it is a substance insoluble in water, it is yet easily soluble in dilute acids, and is therefore

TABLE II.—HAY CROP, 1889.—*Manured Section.*

No. of Plot.	MANURES APPLIED.		SECTION A. Manured 16th April.	SECTION C. Manured 18th May.
	Phosphatic Manures.		Cwt. per acre.	Cwt. per acre.
5	Bone-meal	With nitrogen and potash.	39	35
6	Dissolved bones		48	45
7	Steamed bone-flour		51	48
8	Thomas-slag		57	51
9	Ground mineral phosphates		51	42
10	Superphosphate		51	48
11	No phosphate		51	..
12	Superphosphate alone		18	..
	Nitrogenous Manures.			
13	Nitrate of soda	With phosphate and potash.	54	45
14	Sulphate of ammonia		36	39
15	Horn-dust		36	36
16	Dried blood		36	36
17	No nitrogen		33	..
18	Nitrate of soda alone		42	..
	Potassic Manures.			
19	Sulphate of potash	With nitrogen and phosphate.	69	51
20	Muriate of potash		54	54
21	No potash		48	..
22	Potash salts alone		24	..
	Guanos.			
23	Peruvian (with ammonia)		45	48
24	Fish		36	33
25	Ichaboe		48	39
27	Unmanured continuously		14	..
	Superphosphates.			
28	27 °/ₒ Soluble phosphate	With nitrogen and potash.	48	36
30	36 °/ₒ do do.		42	45
29	Same as Plot 8		51	45
	Complementary Manures.			Manure applied 16th April.
11c	Phosphate alone		..	33
12c	Nitrogen and potash (no phosphate)		..	45
17c	Nitrogen alone		..	48
18c	Phosphate and potash (no nitrogen)		..	24
21c	Potash alone		..	24
22c	Phosphate and nitrogen (no potash)		..	45

somewhat easily dissolved by the acids in the soil, or exuded by the roots of plants. It is remarkable how quickly grass answers to the application of soluble manures, even when applied far on in the growing season. It is evident that the more soluble superphosphate has been more efficacious than the less soluble one (plots 28 and 30), and late-applied Peruvian guano has succeeded very well. There are some plots whose results may seem anomalous. The results on plot 14 are of that kind. The amount of hay produced on that plot is very disappointing, but the cause of the deficiency is easily explained. I made a careful inspection of the station on five occasions—once before manuring, thrice during the growing season, and once in September. On each occasion the average growth of the grasses proper and clovers on each plot was estimated at a percentage, and the kinds of grasses growing on each plot were noted and arranged in what seemed the order of their abundance, and various notes were taken of observations made during each inspection, which occupied a whole day.

In the middle of April, when the manures were applied, plot 14 had a better show of grass than plot 13, but not quite so much clover. Ten days later the nitrate of soda had taken effect, and plot 13 looked richer in grass than plot 14. A fortnight thereafter there was not so great a difference visible in the grass, but there was a great diminution in the amount of clover. It was evident that the clover had received a check, which must have been due to the sulphate of ammonia applied, for that was the only ingredient in the manure which differed from that applied to plot 13. A fortnight thereafter, the clover again began to show itself, though not so prominently as on the C section of the plot. When the manure was put on C section, the clover was more robust, and did not suffer so much from the application of the ammoniacal manure. Nevertheless, it did suffer some injury, and in the middle of September, when the last inspection was made, plot 14 had a tufty appearance, and was not nearly so well covered as plot 13. The plots which received their nitrogenous manure in the form of horn-dust and dried blood were also very backward in their growth, due in their case, however, to a totally different cause, —namely, to the fact that these manures had not time to make themselves felt, for it was noticed in September that these two plots had a very fresh vigorous appearance, and were among the best plots on the station. It is evident that these two slowly acting nitrogenous manures are valuable ingredients in a grass manure, where a good aftermath is wanted, or good pasturage during the autumn months. The abundance of white clover was a prominent feature on these two plots.

Plot 18, which has received nothing but nitrate of soda for eleven years, produced what must be considered a remarkable crop. In 1886, 1887, and 1888, when no manures were applied to the station, the small crops it yielded showed that it was in an exhausted condition; but now that the application of nitrate has been resumed, the signs of exhaustion, so far as bulk of hay is concerned, are no longer visible, for it has produced a crop not much below average.

Nothing was more notable on the station than the wonderful effect of soluble nitrogenous manures in bringing up a good crop of grass. On all the plots manured with it, the grass looked green and vigorous, and wherever it was awanting there was diminished growth, and what would be regarded as a less healthy appearance, so far as the grasses proper are concerned; but it was quite otherwise as regards clover. These flourished well on the plots to which no nitrogenous manure had been applied, but where potash salts formed a constituent of the manure. It was to the abundance of clover in the herbage of plot 17 that the fair crop of hay on that deficiently manured plot was due; and the same remark applies to plot 22, which during the whole course of the experiments has received nothing but potash manures, and which in some years was the poorest plot on the station. The crop is still small, but it compares very favourably with plot 27, which has remained unmanured since the beginning.

The great importance of soluble nitrogenous manures, in immediately bringing up a good crop of hay, is brought prominently to view on comparing the plots to which incomplete manures were applied.

Section A of plots 11 and 12, 17 and 18, 21 and 22, are of that kind. From plots 11, 17, and 21, one of the three manurial constituents has been withheld from the beginning; and from plots 12, 18, and 22, two of the constituents have been withheld. These plots have in past years produced by turns deficient crops, according to the kind of crops under experiment, and their varying produce has helped to emphasise the relative importance of the three manurial constituents, according as roots, cereals, or leguminous crops were grown. It is instructive to see how it stands with them as regards the hay crop. Additional interest is given to the comparison this year, because one-third of each of these plots, viz., section C, has had what are called complementary manures applied to it—that is to say, those which in former years had only one constituent applied to them, are now receiving the other two; and those from which one of the constituents had hitherto been withheld are now receiving that constituent only. The main object in view in adopting this plan, is to see how far it is possible, by supplying the constituents that were awanting in former years, to utilise whatever residues of manure may still be resident in the soil. We may group them in two sets—

those which have produced a heavy crop of hay, and those which have produced a light one.

TABLE III.—INCOMPLETE MANURES.

No.	Kind of Manure.	Section A.	Section C.	Total. A & C.
		cwt.	cwt.	cwt.
11	Nitrate and potash	51	45	96
21	Nitrate and phosphate	48	45	93
18	Nitrate alone	42	48	90
		141	138	279
17	Phosphate and potash . . .	33	24	57
12	Phosphate alone	18	33	51
22	Potash alone	24	24	48
		75	81	156

A glance at these results shows in a striking manner how important soluble nitrogenous manures are for the production of a hay crop. Where nitrate of soda and sulphate of ammonia were applied, the crop is nearly doubled. We shall examine the matter from another point of view when we come to describe the character of the hay produced, but we may notice here a confirmation of the results obtained on section B which have already been referred to.

The incomplete manures applied to section C of these six plots were intended to utilise whatever residues of former manurings might still be available after three crops had been taken away without the application of manure. It is seen that the complementary manures have failed to find their complement in the soil, or in other words the residues are either nearly exhausted or not available.

The quantity of nitrogenous manure applied to each plot would be equivalent to about 190 lb. nitrate of soda per acre, which is not too much for a soil from which everything that has been grown has been removed, which has had no farmyard manure put on it for fifteen years, and which has been cropped for three years without manure. But as nitrate of soda is of the first importance as a manure for grass, especially where it is annually cut for hay, two plots were set apart to test the effect of that manure when applied to grass in increasing quantities. Plots 31 and 32 were divided each into three parts, and to one part the nitrate was applied at the rate of 1 cwt. per acre, to another at 2 cwt. per acre, and to the third at 3 cwt. per acre. The amount of hay yielded by these plots was as follows:—

	Nitrate of Soda per acre.		
	1 cwt.	2 cwt.	3 cwt.
Plot 31, cwt. . . .	33	39	48
Plot 32, " . . .	36	42	48

Had the land been in high condition, the application of 3 cwt. of nitrate of soda per acre would probably have resulted in the lodging of the crop, but as it was it is evident that the dose might have been increased to some extent. So far as quantity of crop is concerned, each additional cwt. of nitrate yielded an increase of about 6 cwt. of hay.

Samples of these crops were taken and subjected to chemical analysis, in order to see how far the increased quantity of crop had been got at the expense of quality. I was prepared to find a considerable difference, especially in the proportion of albumen contained in the three samples of grasses, and expected that the grass that was heavily top-dressed with nitrate would be of poorer quality, but it is seen that there is very little difference in the quality of the hay produced on the three sections.

	Nitrate of Soda.					
	1 cwt.		2 cwt.		3 cwt.	
	Plot 31.	Plot 32.	Plot 31.	Plot 32.	Plot 31.	Plot 32.
Moisture . .	14.96	13.60	14.50	14.10	14.80	14.40
Albumen . .	4.44	4.97	4.17	4.47	4.88	5.37
Amides, &c. .	1.06	1.26	1.05	.64	.85	1.25
Carbohydrates .	52.09	48.38	51.42	49.27	48.22	50.65
Woody fibre .	21.66	25.42	23.88	25.47	24.43	22.73
Ash . . .	5.79	6.37	4.98	6.05	6.82	5.60
	100.00	100.00	100.00	100.00	100.00	100.00

There is practically no difference in the feeding quality of these grasses. The differences that do exist may be easily accounted for by the difficulty of obtaining absolutely accurate samples. It must not be forgotten, however, that the land was in hungry condition, for even the heaviest manured parts did

not yield so large a crop as was produced on some of the other plots on the station.

BOTANICAL COMPOSITION OF HAY CROP, 1889.

To determine the composition of a hay crop with any degree of accuracy is a work of considerable difficulty, but it is at once a most interesting and instructive thing to know how the various kinds of manure operate in encouraging or otherwise the growth of the individual species of plants included in a mixture of grass seeds. This subject has received a most careful study at Rothamsted, and forms one of the most interesting exhibitions at that famous agricultural station. The experiments there are being carried out not upon young grass but upon very old pasture. It is none the less, but all the more, desirable on that account that a somewhat similar line of investigation should be pursued in Scotland, under conditions of soil and climate widely different from those in the south; and it is also desirable that Scottish farmers should have the opportunity of seeing for themselves a practical illustration of the specific effects of various manures upon the quality as well as the quantity of a hay crop.

It was chiefly with the view of checking the final determination of the amounts of the various species grown upon the plots, that careful inspections of the herbage were made during the growing season, and the proportion of the various species found on the plots roughly estimated so far as could be determined by mere superficial observation.` It is to such superficial observation that a farmer must trust while walking over his meadows to discover what is the relative predominance of the various species of grass. It is evident, however, that an inspection of that kind can at best give him an idea of the *numerical* predominance of the various species. He may find, for instance, that for every individual head or plant of cocksfoot he sees, there are two heads or plants of meadow-grass or of crested dog's-tail; but it is evident that unless he knows what are the relative weights of an entire plant of each of these grasses, his inspection will give him no idea of the quantity by weight of those grasses that will be found in his hay crop.

The number of individual plants of crested dog's-tail may be four times as great as that of cocksfoot, and yet the actual weight of the former may be much less than that of the latter.

In order to get an approximate estimate of the relative weights of individual plants of the different species, I selected 100 plants of each—viz., the flowering stems and the leaves appertaining to them, taking good average samples—and dried and weighed them, with the following round results:—

WEIGHTS of 100 HEADS of GRASSES WITH RESPECTIVE LEAVES (DRY).

	Grains.
Rye-grass (*Lolium perenne*),	370
Cocksfoot (*Dactylis glomerata*),	3200
Timothy (*Phleum pratense*),	1400
Dog's-tail (*Cynosurus cristatus*),	610
Foxtail (*Alopecurus pratensis*),	600
Meadow-grass (*Poa trivialis*),	250
Tall fescue (*Festuca elatior*),	660
Sheep's fescue (*Festuca ovina*),	160
Yorkshire fog (*Holcus lanatus*),	420

These figures show the relative weights of the grasses as found on Pumpherston, but they do not necessarily apply to similar grasses grown on other soils; for it is well known certain soils are more favourable to the growth of some species than others are, and I should think that on most soils crested dog's-tail will not be found to attain the same luxuriance as at Pumpherston, where it is a strong and predominant grass.

There is another circumstance which tends to create a false impression of the character and composition of the grasses grown upon a meadow. Some species of grass, such as meadow-grass and Yorkshire fog, from the spreading nature of their flowers, appear to form a much greater proportion of the herbage than they do in reality, so that in forming an estimate of the value of a meadow by mere inspection one is apt to be very far misled. It is only when careful samples are taken and separated out into their different species, and each species weighed and counted separately, that it is possible to arrive at a correct estimate of the value of a pasture.

This was done with the grasses growing on the plots at Pumpherston, and the results are shown in Tables V. and VI. It is not an easy matter to sample a meadow, but as the value of the determinations made depends on the accuracy of the sampling, I must in the first place explain how this was done. Immediately after the grass on each plot was cut three persons walked up the plot, one in the centre, and the others at each side of him, and picked small bunches of the grass every few yards. The samples gathered by one were spread along in a thin layer on the ground, and those gathered by the others were spread in a similar manner on the top of the first. From the united layers samples were selected by sticking a two-pronged fork down through the grass into the ground, and taking all the grass enclosed between the prongs of the fork. Three fork samples were made of the grass of each plot, and these united formed what was regarded as a fair sample of the plot. It was carefully wrapped up in paper and taken to the laboratory for analysis.

On Table V. (p. 372) is given the number of plants of the different species of grasses proper found in the samples, and when these numbers were compared with the rough estimates made during the last two inspections of the growing crop, it was found that the relative proportion accorded to the different grasses in the herbage agreed very closely with that which was found in the samples, and satisfied me that the samples were to be trusted as fairly representing the total crop.

On the line above the table is given the percentage of germinating seeds that were sown out with the barley crop, so that the mortality among the various species, or if not the mortality, at least the want of vigour or inability to produce flowering stems, may be noted.

The first year's grass of 1888 consisted almost exclusively of rye-grass. A few other grasses were visible—viz., Timothy grass, Crested Dog's-tail, and Yorkshire fog—but they did not average much more than 10 per cent of the grasses proper. In the second year's grass the rye-grass is still far ahead of the others, averaging upwards of 60 per cent, or about one-third less than last year. There are still as many plants of it as there ought to be from the number of seeds originally sown, but it is of course inevitable that a considerable proportion of these have sprung from seed which fell from the first year's hay crop. The Poas are present to the extent of about half their normal number. Timothy has increased about two-fold, and cocksfoot, which had not flowered the first year, is now competing with it, but both are far behind their proper proportion. The fescues are still far back, and foxtail has scarcely been able to make headway. The most surprising progress has been made by crested dog's-tail, which is already five times more abundant than it ought to be, considering the number of seeds that were planted; and Yorkshire fog, which was self-sown on the station, is pretty prevalent on some of the plots.

It is unnecessary here to discuss the individual differences exhibited by the different plots as regards the number of flowering plants it has produced, as no distinction is made between those that are of puny growth and those that are robust. The numbers, moreover, do not indicate the actual proportion of the seeds which have germinated, but only those which have progressed so far as to throw up flowering stems. They may be regarded, however, as giving a fairly accurate picture of the outward appearances of second year's grass grown under the conditions found on the various plots.

Generally speaking, the most vigorous flowering occurred on the plots receiving soluble nitrogenous manures. The grass which was least dependent on nitrogen for the production of flowering stems was the crested dog's-tail, which flowered most abundantly, on plots which either had no nitrogenous manures applied to them, or which got them in an insoluble form. Yorkshire fog shows the same peculiarity, but whether the abundance of these two species may be characteristic of the grass grown on soils deficient in nitrogen remains to be seen. It is too soon to generalise on such matters.

On Table VI. (p. 374) are shown the percentages by weight of the different grasses. The results differ from those of the former table in the more prominent position taken by cocksfoot, whose thick stems and heavy heads cause it to far outweigh the other species of grass.

Timothy also is a heavy grass, and it also is a more important constituent of the hay crop than would have been supposed from its appearance. On the other hand, the Poas contribute very much less to the weight of the hay than one would have expected from their abundance.

In Table VI. the clovers are included, and it is seen that in second year's grass they occupy a very subordinate position. On comparing this table with the corresponding one of the former year a great contrast presents itself. The first year's grass consisted by weight of about 50 per cent rye-grass, 40 per cent clover, about 5 per cent natural grasses, and about 5 per cent of what might be classified as weeds. The second year's grass is seen to consist of about 40 per cent by weight of rye-grass, about 55 per cent natural grasses, and only about 5 per cent of clovers; so that the great difference between the first and second year's grass consists in this, that the clovers have almost disappeared, and the natural grasses have taken their place.

Any considerable departure from this general description must be regarded as due chiefly to the manuring; and though it is too soon to draw any definite conclusions in this respect, seeing that the manures have been resumed only for one year, we may yet notice one or two circumstances which claim attention regarding the distribution of grasses and clovers. The plots with the highest percentage of clover are those which got no nitrogenous manures; next to them come those whose nitrogenous manures were insoluble; and lastly, those with soluble nitrogenous manures. It is thus seen that, while soluble nitrogenous manures are of the first importance for the grasses proper, they are of little or no importance for clovers. The manurial constituent which has done most for the clover is potash. The plots which contained the greatest proportion of clover were plot 17, which got superphosphate and potash salts, and next it is plot 22, which got nothing but potash manure.

Even the total weight of clover produced on plot 22 is far in excess of the average yield of the station. This is seen on Table VII. (p. 376), which shows the total weight per acre of the different kinds of herbage grown on the plots.

TABLE V.—HAY CROP, 1889. NUMBER OF GRASS PLANTS OF EACH SPECIES (PER. CENT).

No. of Plot.			Rye-grass.	Cocksfoot.	Timothy.	Dogs-tail.	Fox-tail.	Poas.	Tall Fescue and Meadow Fescue.	Sheep's Fescue and Hard Fescue.	Holcus.
	Percentage in the mixture sown		6.6	13	16	3.2	9.1	35	8.2	8	...
	Phosphatic Manures.										
5	Bone-meal	With nitrogen and potash.	53	1.4	2.5	14	...	14	...	...	14
6	Dissolved bones		60	2.2	4.1	10	...	11	1.3	4	7
7	Steamed bone-flour		64	1.8	2.6	13	...	11	1.5	.6	5
8	Thomas-slag		71	1.5	3.7	9	...	10	.7	...	5
9	Ground mineral phosphate		57	2.5	3.4	11	...	8	1	1.2	16
10	Superphosphate		72	1.2	2.1	9	.4	9	.4	2.6	3
11	No phosphate		59	1.7	4.4	12	...	10	.8	1.0	11
12	Bone-ash alone		63	.8	2.1	21	...	6	2.3	1.0	3
	Nitrogenous Manures.										
13	Nitrate of soda	With phosphate and potash.	63	1.9	1.5	11	.4	20	.4	...	1.5
14	Sulphate of ammonia		62	2.1	3.4	17	...	11	1.4	1.2	2.1
15	Horn-dust		61	1.4	2.4	16	...	14	.6	1.3	3
16	Dried blood		59	1.7	1.6	22	.4	11	1.6	...	2.3
17	No nitrogen		58	2.8	3.0	22	...	7	1.8	2.0	4.3
18	Nitrate of soda alone		71	1.1	2.3	7	.7	14	.6	1.0	1.9

	Potassic Manures.									
19	Sulphate of potash } With nitrogen and phosphates.	67	4	5	11	.1	5	2	.5	5
20	Muriate of potash	65	2.5	4.5	14	.2	6	1.1	.9	4
21	No potash	64	1.7	4	13	...	10	2.3	1.7	2
22	Potash salts alone	60	1.6	2	14	...	18	2.1	1.2	.7
	Guanos.									
23	Peruvian	64	2.0	5	12	.3	14	1.8	.4	.4
24	Fish	59	1.5	4	13	...	13	2.1	1.2	3.8
25	Ichaboe	53	1.9	7	6	...	27	1.9	.5	2.2
27	Unmanured continuously	68	.7	4	6	.2	15	1.8	1.0	2.8
	Superphosphates.									
28	27 per cent soluble phosphate } With nitrogen and potash.	49	1.8	4	15	...	23	1.5	.4	5
30	36 per cent do.	59	2.5	3	16	...	16	1.5	.2	1.6
29	Same as plot 8	69	1.2	3	7	.1	14	1.0	.4	3
	Complementary Manures.									
11*c*	Phosphate alone	59	1.6	3	14	...	11	2.4	1.9	7
12*c*	Nitrogen and potash (no phosphate) . . .	67	2.1	5	12	...	9	1.4	1	2.2
17*c*	Nitrogen alone	54	2.7	3	8	.4	21	2.2	1	7
18*c*	Phosphate and potash (no nitrogen) . . .	73	1.8	2.9	10	...	8	3	...	.7
21*c*	Potash alone	65	.6	4	19	...	4	3	1.3	2.5
22*c*	Phosphate and nitrogen (no potash) . . .	63	1.9	2.4	8	.4	20	1	.4	2.7

TABLE VI.—HAY CROP, 1889. BOTANICAL ANALYSIS. WEIGHT OF DIFFERENT SPECIES OF GRASSES (PER CENT).

No. of Plot.			Rye-grass.	Cocks-foot.	Timothy.	Dogs-tail.	Fox-tail.	Meadow-grasses.	Tall and Meadow Fescues.	Hard and Sheep's Fescues.	York-shire Fog.	Red Clover and Cow-grass.	Alsike and White Clover.	Weeds.
	Phosphate Manures.													
5	Bone-meal	With nitrogen and potash.	38	10	9	18	...	8	...	...	13	2	2	...
6	Dissolved bones		40	15	13	13	...	6	2.1	1.1	6	3	.8	.2
7	Steamed bone-flour		46	13	9	17	...	6	2.5	.2	4	2.2	1	...
8	Thomas-slag		50	11	13	12	...	5	1.1	...	4	2	2.3	.6
9	Ground mineral phosphate		36	15	10	12	...	4	2	.3	13	3	5	.9
10	Superphosphate		54	9	7	13	.5	5	.6	.9	3	6	1.2	...
11	No phosphate		39	11	14	14	...	5	1.2	.3	9	1.6	3	.7
12	Bone-ash alone		44	5	8	27	...	3	4	.3	2.4	2.1	2.4	1.5
	Nitrogenous Manures.													
13	Nitrate of soda	With phosphate and potash.	47	14	5	15	.5	12	.7	...	1.4	2.1	2.1	...
14	Sulphate of ammonia		41	14	11	20	...	6	2.2	.4	2	2.4	.3	.9
15	Horn-dust		43	9	8	20	...	7	1	.4	2.7	1.6	6	.3
16	Dried blood		40	11	5	27	.5	6	3	...	2	1.6	2.3	.5
17	No nitrogen		31	15	8	22	...	3	2.4	.5	3	3	12	...
18	Nitrate of soda alone		56	8	9	10	1	8	1	.4	2	1	2.3	.5

	Potassic Manures.												
19	Sulphate of potash } With nitrogen and phosphate.	45	20	13	11	...	2.1	2.7	.1	3.4	1.4	.8	.1
20	Muriate of potash	43	17	12	16	.3	2.7	1.2	.3	3	4	.4	.4
21	No potash	45	12	14	17	...	6	4	.5	1.6	...	1.2	.3
22	Potash salts alone	40	10	6	17	...	9	3	.4	.6	8	4.5	...
	Guanos.												
23	Peruvian	42	13	15	14	.3	7	3	.1	.3	2.4	1.9	...
24	Fish	40	10	15	16	...	7	3	.4	3	2.1	2.3	...
25	Ichaboe	35	12	23	7	...	14	3	.2	2	.6	1.4	.3
27	Unmanured continuously	52	5	14	9	.2	9	3	.4	2.7	.2	3.2	.5
	Superphosphates.												
28	27 per cent soluble phosphate } With nitrogen and potash.	34	12	14	19	...	12	3	.1	4	.4	.6	...
30	36 per cent do.	41	17	9	19	...	9	2.4	.1	1.4	.6	.7	...
29	Same as plot 8	55	9	11	10	.2	9	2	.2	3	...	1.1	.2
	Complementary Manures.												
11*c*	Phosphate alone	38	10	9	17	...	5	4	.6	5	7	3	.7
12*c*	Nitrogen and potash (no phosphate) . . .	44	14	17	14	...	5	2.2	.3	1.9	.3	.5	1.3
17*c*	Nitrogen alone	37	18	11	10	.5	11	3	.3	6.1	1.8	.6	.5
18*c*	Phosphate and potash (no nitrogen) . . .	49	11	9	12	...	4	5	...	.6	1.3	8	.2
21*c*	Potash alone	45	4	12	24	...	2.2	5	.4	2.2	...	4	1.2
22*c*	Phosphate and nitrogen (no potash) . . .	48	14	9	11	.5	11	1.8	.1	2.6	.3	1.4	.5

TABLE VII.—HAY CROP, 1889. WEIGHTS OF DIFFERENT SPECIES (CWTS. PER ACRE).

No. of Plot.			Rye-grass.	Cocks-foot.	Timothy.	Dogs-tail.	Fox-tail.	Meadow-grass.	Tall and Meadow Fescue.	Hard and Sheep's Fescue.	York-shire Fog.	Red Clover.	Alsike and White Clover.	Weeds.
	Phosphatic Manures.													
5	Bone-meal	With nitrogen and potash.	15	4	3	7	...	3	...	..	5	.8	.8	...
6	Dissolved bones		19	7	6	6	...	2.6	1	.5	3	1.5	.4	.1
7	Steamed bone-flour		23	6	4	8	...	3	1.3	.1	2.2	1.1	.5	...
8	Thomas-slag		29	6	7	6	...	2.7	.6	...	2.5	1.1	1.3	.3
9	Ground mineral phosphate		18	8	5	6	...	1.9	.8	.2	6	1.5	2.6	.5
10	Superphosphate		27	4	4	6	.2	2.5	.3	.5	1.4	3	.6	...
11	No phosphate		20	6	7	7	...	2.7	.6	.1	5	.8	1.7	.4
12	Bone-ash alone		8	1	1.4	5	...	.6	.7	.1	.4	.4	.4	.3
	Nitrogenous Manures.													
13	Nitrate of soda	With phosphates and potash.	25	8	2.9	8	.3	6	.4	...	.8	1.2	1.2	...
14	Sulphate of ammonia		15	5	9	7	...	2	.8	.1	.7	.8	.1	.3
15	Horn-dust		15	3	2.9	7	...	2.7	.4	.1	1	.6	2.2	.1
16	Dried blood		14	4	1.9	10	.2	2.2	1	...	.7	.6	.8	.2
17	No nitrogen		10	5	2.6	7	...	1	.8	.2	1	1	4	...
18	Nitrate of soda alone		23	3	4	4	.4	3	.5	.2	.8	.4	1	.2

	Potassic Manures.												
19	Sulphate of potash } With nitrogen and phosphates.	28	16	9	8	.1	1.6	2.0	.1	2.8	1.1	.6	...
20	Muriate of potash	23	12	6	7	.1	.8	.8	.1	1.7	1.8	.2	.2
21	No potash	21	5	7	8	...	2.6	1.8	.3	.8	...	.6	.1
22	Potash salts alone	10	2.4	1.5	4	...	2.2	.8	.1	.1	2.0	1.1	...
	Guanos.												
23	Peruvian	20	6	7	7	.2	4	1.4	.1	.2	1.2	.9	...
24	Fish	14	4	5	6	...	2.5	1.2	.1	1.2	.8	.8	...
25	Ichaboe	17	6	11	4	...	7	1.4	.1	.9	.3	.7	.2
27	Unmanured continuously	7	.7	2	1.2	...	1.2	.5	.1	.4	...	.4	.1
	Superphosphates.												
28	27 per cent soluble phosphate } With nitrogen and potash.	16	6	6	9	...	6	1.2	.1	2.2	.2	.3	...
30	36 per cent do.	17	7	4	8	...	4	1.0	...	.6	.2	.3	...
29	Same as plot 8	28	4	5	5	.1	4	1.0	.1	1.5	...	.6	.1
	Complementary Manures.												
11*c*	Phosphate alone	12	3	3	5	...	1.7	1.1	.2	1.8	2.4	1	.2
12*c*	Nitrogen and potash (no phosphate) . . .	20	6	7	6	...	2.1	1	.1	.8	.1	.2	.6
17*c*	Nitrogen alone	17	9	5	5	.2	5	1.7	.1	2.9	.8	.3	.2
18*c*	Phosphate and potash (no nitrogen) . . .	12	2.7	2 2	2.8	...	1	1.1	...	.1	.3	1.9	...
21*c*	Potash alone	11	1	2.9	6	...	.5	1.3	.1	.5	...	.9	.3
22*c*	Phosphate and nitrogen (no potash) . . .	21	6	4	5	.2	5	.8	.1	1.2	.1	.6	.2

ANALYTICAL ASSOCIATIONS.

THE PURCHASE AND ANALYSIS OF MANURES AND FEEDING-STUFFS.

During the year 1889 a considerable increase has occurred in the number of Local Analytical Associations who conduct their operations in accordance with the regulations of the Highland and Agricultural Society, and thereby qualify themselves to receive money grants in aid of the cost of analysis. The value of the grant was originally half-a-crown and five shillings, according as one or more constituents of a manure or feeding-stuff were determined. In 1884 the value of the grant was doubled, as the number of applications was not one-fourth of what was expected.

The subjoined statement shows the number of associations, the number of analyses for which grants were obtained, and the amount of the grant in each year since the scheme came into operation.

Analyses through Associations, 1881-89.

	No. of Associations.	No. of Analyses.	Amount of Grant.
1881 . .	13	221	£54 10 0
1882 . .	14	202	49 0 0
1883 . .	10	143	33 10 0
1884 . .	15	255	122 15 0
1885 . .	16	255	112 5 0
1886 . .	15	226	96 0 0
1887 . .	14	216	92 5 0
1888 . .	14	187	77 15 0
1889 . .	18	257	107 15 0

It is seen that with slight fluctuations the number of associations claiming the Society's grant has remained about the same as it was at the beginning. Some new associations joined and others dropped off, but during last year an unusual increase has occurred.

The increase in 1884 was due to the doubling of the grant, so that some associations which had dropped off thought it worth while to resume connection with the Society. The objects the Society had in view in giving grants to associations were chiefly three. Firstly, to assist them in their useful work; secondly, to relieve them of the responsibility incurred in publishing any instances of culpable carelessness or actual fraud in the supply of manures or feeding-stuffs; and thirdly, to secure that justice should be done to manure-merchants or their agents, by requiring that manures should be properly sampled and distinctly guaranteed, and that every opportunity should be given to sellers to vindicate or explain any deficiencies that might occur. The regulations drawn up to attain these objects were at first somewhat irksome, but year by year improvements have been introduced, so that now they are a means of lightening rather than increasing the labour of secretaries of analytical associations, and there is every inducement offered to outsiders to fall in with the Society's scheme.

In contributing money grants to associations, the Society is adopting a policy which is, to say the least of it, disinterested, for the great majority of those who obtain analyses through the associations are not members of the Society. The 257 analyses receiving grants last year were distributed among 120 buyers, of whom only 47 were members of the Society. Half of these buyers had one analysis each, so that about 200 analyses were done for the other half, the majority of whom had two analyses; but many had three, and some had four and five, and even as many as eight analyses, for which grants were given irrespective of whether the buyers were members of the Society or not. It is to be hoped that those members of associations for whose analyses the Society contributes so liberally, will give it the benefit of their support by joining its membership.

The number of analyses sent in by each association, and the grants which they received, are shown in Appendix B., p. 38, but it is instructive to note what was the nature of the purchases made by the associations in the various districts of the country. These are shown in the subjoined table (p. 380).

If we could regard the purchases made through the associations as representative of the general kind of purchases made by farmers throughout Scotland, this table would enable us to gauge the opinion of farmers as regards the kind of manures that are most useful and economical to employ, but we are scarcely justified in making that assumption. It is probable that members of analytical associations are upon the whole better informed than the general farmer on the matter of manure buying. It is one of the advantages of such associations that the members are accustomed to compare notes and discuss the subject of manuring among themselves; and they also have the opportunity of receiving instruction from their chemists occasionally regarding the kinds and qualities of manures that are most profitable. Moreover, the analyses for which the associations receive grants are only such as are purchased under proper guarantees, and sampled in accordance with the

MANURES AND FEEDING-STUFFS FOR WHICH GRANTS WERE GIVEN, 1889.

	Alford.	Arbroath.	Avondale.	Buchan.	Carse of Gowrie.	Galston.	Grougar.	Kelso.	Kintyre.	Kirkcud-bright.	Lanark.	Moray.	Nairn.	Easter Ross, 1888.	Easter Ross, 1889.	Wester Ross.	Stoneykirk.	Strathearn.	Turriff.	Total, 1889.
Bones	9	3	1	8	1	1	1	5	...	8	2	4	3	4	2	11	2	6	10	81
Dissolved bones . . .	...	...	1	...	1	2	...	...	2	5	2	...	4	1	...	2	...	...	1	21
Superphosphate . . .	5	3	1	2	3	...	...	3	2	3	2	2	5	4	2	10	2	2	4	55
Dissolved compounds . .	1	3	...	...	2	...	...	...	...	4	5	...	2	...	...	2	...	...	9	28
Guanos	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	1	...	1	...	4
Fish and flesh manures .	...	1	...	...	...	...	...	...	...	1	...	4	...	1	...	...	...	1	3	11
Slag	...	...	...	...	...	...	...	...	1	...	1	...	...	...	4	...	...	...	3	9
Nitrate of soda . . .	...	3	1	...	...	...	1	1	1	...	1	...	...	...	...	3	...	...	1	12
Sulphate of ammonia . .	...	2	1	...	1	...	1	1	1	...	1	...	...	...	...	1	...	...	1	10
Potash salts . . .	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1	...	...	...	...	2
Oilcakes	4	7	...	...	1	...	...	2	...	...	...	...	2	1	3	2	...	2	...	24
	19	22	5	10	10	4	3	12	7	21	15	10	16	11	12	32	4	12	32	257

Society's regulations. But many of the samples analysed for associations refer to purchases which do not come under that category, and they are therefore not included in the returns. There are other reasons which make it improbable that these returns are fairly representative. It is not every purchase that farmers make, whose details they would care to see published in the annual reports of the associations, and there are some which they may not consider as requiring an analysis. There are few farmers, for example, who do not use nitrate of soda, but yet that manure forms only one-twentieth of the samples recorded.

Nevertheless the table conveys some useful lessons.

Bones.

More than one-third of the manures analysed were bones of some kind, and it is easy to see by the values put on them by the chemists of the associations that they were almost all samples of very fine bone-meal, more finely ground than any samples that were in the market a few years ago, while the rough bone-dust and quarter-inch bones that used to be so much appreciated have almost entirely disappeared. It is satisfactory to see that the lessons taught at the experimental stations have been so well learned, and that the strong prejudice in favour of rough bones has been removed. In attaining this result we must acknowledge the services rendered by implement-makers, for at the time when fine grinding of bones began to be insisted on, I was informed by manure manufacturers that no machinery existed in the country capable of grinding bones down to the standard of fineness recommended by the Society; but thanks to the efforts of implement-makers, there seems to be no difficulty in attaining the desired degree of fineness nowadays. Among the bones are included a few samples of steamed bone-flour.

Superphosphates.

Next to bones comes superphosphate, which is gradually gaining the appreciation of the farmers as the cheapest and most effective form in which to buy soluble phosphate. Moreover, that kind of superphosphate is chiefly in request which the experiments at the stations have shown to be the most useful—namely, a medium superphosphate containing from 25 to 28 per cent of soluble phosphate. There need be no hesitation in the mind of a farmer as to what is the best kind of superphosphate to buy. It is that kind which gives soluble phosphate at the lowest price per unit, and that is just the medium superphosphate.

These two manures, bone-meal and superphosphate, are in general demand and represented in nearly all the associations, but it is noticeable that the demand for bone-meal is greatest in districts where light land is most prevalent, and that superphosphate has the preference when the general character of the land is heavy. These two manures constitute 60 per cent of all the manures contained in the returns of the association last year.

Dissolved Compounds.

Next in importance are the dissolved compounds, which include turnip, potato, and grain manures, and also a good many manures which were formerly sold under the name of dissolved bones. Owing to the requirements of the Merchandise Marks Act, many manures which were formerly classified as dissolved bones are now called "dissolved bone manures," or some such name. This is a very satisfactory state of matters. The Chemical Committee have all along desired that the name "dissolved bones" should be applied only to the genuine article; but manufacturers on whom they pressed their views expressed their regret that, however desirable the change, the trade could not be got to agree upon the subject. Now that an Act has been passed making it penal to sell under the name of dissolved bones anything that is not natural bones and sulphuric acid (or other solvent), certain manufacturers who still sell spurious manures under the name of dissolved bones will consult their own interests by immediately discontinuing the practice. It may be that some of the soluble compounds sold wrongly under the name of dissolved bones are quite as good as the latter, but they ought not to be sold under a name which is purposely misleading. There are manufacturers who, with much labour and skill, are able to produce genuine dissolved bones of high quality; and it is only just to them that their manures should not have to compete with those made from cheaper materials, whatever be their agricultural value; and it is also due to farmers that, when they order dissolved bones, they should be secured against imposition. But for the legislative change referred to, it is probable that the samples classified as dissolved bones would have outnumbered the other dissolved compounds as they used to do; and, on the other hand, if sellers paid universal respect to the Act, it is probable that the number of dissolved compounds would more than double that of dissolved bones.

As there is no very sharp line of division possible this year, we may group them together so as to be able to compare the manures analysed for associations in 1889 with those of 1881, when the Society's scheme started. The numbers are as follows:—

			Per cent.	
	1881.	1889.	1881.	1889.
Bones	33	81	17	35
Superphosphates	30	55	15	24
Dissolved bones and dissolved compounds	103	49	53	21

It is evident from these figures that a great change has been brought about in the minds of farmers on the subject of manures since the Society began to give its assistance to the associations. At that time attention was forcibly drawn to the losses sustained in the purchase of dissolved manures which were both poor in quality and high in price, and farmers were recommended to purchase standard substances—such as bone-meal and superphosphate—and make their own mixtures. It was evident, in the returns of succeeding years, that they were not slow in accepting the advice given them. The proportion of dissolved compounds rapidly fell from upwards of 50 per cent of the total manures down to less than 25 per cent, and the proportion of bone-meal and superphosphate became greater year by year. During the past year the dissolved compounds form only about a fifth of the manures recorded; but even that is greater than it was the former year, showing that there is a tendency to resume the purchase of these substances. It is evident from the prices at which these compounds were bought, and from their quality as shown by analysis, that there is not the same risk attending their purchase now as there was eight or nine years ago. Manure-merchants are now more careful to supply these manures of good quality, and they are content with smaller profits.

So long as dissolved compounds and special manures are bought on the basis of their analysis, at fair and reasonable prices, farmers need not hesitate to use them. There is a vast amount of waste material derived from a great variety of sources rich in manurial properties, and which in the hands of the manufacturer can be worked up into manures of excellent quality, and be brought into fine condition for applying to the land. It is only right that they should be used for the benefit of agriculture, which in these days stands in need of all the aids that are available for it, but they must be obtained at a price that will make their employment profitable. They must not be dearer, but rather cheaper, than the simple manures that farmers can buy and mix for themselves. It is only when they are of poor quality, and when virtues are claimed for them that they do not possess, and when, moreover, they are sold at prices far beyond their agricultural value, that farmers require to be warned against their use. When special manures are sold under an analytical guarantee, and found on analysis to be as good as the guarantee, farmers may safely invest in them if they can do so at prices corresponding to their value, as determined by the Society's units of valuation.

Valuation Units.

A very marked feature of the returns sent in by the associations last year is that the vast majority of the manures supplied were better than their guarantees, and the prices were for most manures rather under than over the values according to the Society's units of valuation. The units for valuation issued by the Society each February are very carefully adjusted, so as to harmonise with the market prices, but it may sometimes happen that circumstances occur to affect market prices during the succeeding four months. A circumstance of that kind occurred in March 1889, when the arrival of very large cargoes of bones from India lowered the price of bone-meal, which, before that event, had showed rather an upward tendency. Accordingly the valuations of bone-meal were from five to ten per cent above the selling prices at some places. Such fluctuations are inevitable, but they do not affect the general utility of the Society's scheme of valuation, which is meant chiefly as a guide to small buyers, who cannot expect to obtain their manures on the same advantageous terms as those who purchase large quantities. Large buyers do not require a set of units for their guidance—they can always command the lowest price in the market; while small buyers have the satisfaction of knowing that if the price they have paid for their manures is somewhat near the value arrived at by means of the units, they have no reason to complain of overcharge. Among the manures recorded last year there were only about half a dozen that were sold at prices far above their market value.

Thomas-Slag.

The returns last year include nine analyses of Thomas-slag, showing that this cheap and effective kind of phosphate is now attracting the attention of farmers. Numerous experiments made with it by associations of farmers, at the instigation and under the guidance of the Chemical Committee, have proved that it is a good serviceable manure, capable of taking the place of superphosphate, especially on the lighter class of soils.

Nitrate of Soda and Sulphate of Ammonia.

There is an increase in the number of analyses of nitrate of soda and sulphate of ammonia recorded, and the standard of excellence of these manures leaves nothing to be desired. The erroneous opinion that these manures are mere stimulants, which impoverished the soil, is rapidly disappearing, and farmers are at length appreciating the fact that these substances are the most powerful nitrogenous manures at their command, so long as they are applied along with phosphates, and as an adjunct to the heavier manures of the farm. It is only when these manures are applied in too great proportion, or in an ignorant manner, that they can do any injury to the farm or be a source of loss. The prejudice against the use of nitrate of soda, which is just now the cheapest nitrogenous manure in the market, will soon die out as farmers become better acquainted with the circumstances in which it can be most profitably employed, and what are the proper proportions in which to use it. That injury has been done in the past by its indiscriminate use is undoubted; but when it is better known that all the nitrogenous matter which plants extract from the soil has, in the first place, to be converted into nitrate, the evil reputation that it has acquired will be removed, and those who have avoided it heretofore will learn to use it properly, and discover its true use and value.

Oilcakes and Feeding-Stuffs.

The number of analyses of oilcakes and feeding-stuffs is far short of what it ought to be, whether we consider the quantity of these substances used and the amount of money invested in them, or the importance of having them supplied of good quality. There is a tendency at present to underrate the value of analysis as applied to feeding-stuffs, just as there was at one time regarding the value of manure analysis, but that this tendency is an erroneous one admits of very easy proof. Feeding-stuffs owe their value to the amount of albumen, oil, and carbohydrates they contain, just as manures owe their value to the amount of ammonia, phosphoric acid, and potash they yield. The feeding value of the one and the manurial value of the other differ according to the source from which they are derived, and to the proportions in which they exist in the materials bought; but, however we may classify them, it is for the sake of the three ingredients referred to that they are used. It is evident, therefore, that if they are to be bought intelligently, their price must be regulated by their analysis.

But analysis shows that feeding-stuffs of the same kind may vary very greatly in composition, and the name they are sold under affords no measure of their feeding value.

Feeding-stuffs of the same kind are sold under different brands, but the brand does not guarantee the feeding quality of a feeding-stuff, any more than it guarantees the fertilising property of a manure. It is only when the brand is found to be associated with a certain amount of food ingredients, that it can be of use as a guide to the buyer; but the value of a feeding-stuff of any brand can only be determined by analysis. It is needless to pursue the argument further in this place, and to meet other more trivial objections to the use of analysis in the purchase of feeding-stuffs. It is admitted that we do not know so much about the feeding value of fodders as we do about the manurial value of manures; but it is by means of careful experiment, under the guidance of analysis, that our knowledge will be extended in the one direction, as it has been in the other.

One reason why the analyses of feeding-stuffs sent in by the associations are so few is, that merchants frequently do not buy them under an analytical guarantee, and therefore they refuse to run the risk of selling them on that basis; but that is a matter that requires reform, and farmers have it in their power to work the reformation. They have only to insist upon an analytical guarantee, and it will be forthcoming. By no other way can they advance one step in the science of feeding; and until they adopt it, they must expect to suffer loss in the purchase of feeding-stuffs, as they have done in the purchase of manures.

Deficient Manures.

Among the 233 manure analyses there were a few cases of deficiency, but, with the exception of two, they were capable of satisfactory explanation, and were not such as to require that special notice should be taken of them in this report. The two which were very deficient were a dissolved compound and a sample of dissolved bones. The sellers acknowledged the deficiencies, and made an allowance for them on the basis of the Society's units. The fact that such an arrangement was come to between buyer and seller, is no reason why the details should not be published; but the Committee find that the seller had not had due notice given him of the date of sampling. The notice came so late that he could not make arrangements for having an agent present to see the samples drawn; and, though the Committee are quite satisfied that the samples were properly taken, they think it due to the seller that, as he desired to have the sampling witnessed and had not a proper opportunity given him, his name and the circumstances should not appear in this report.

The Committee, while most anxious to do everything in their power to protect farmers against loss from the supply of deficient manures, will not be tempted to do so unless the interests of the seller have received due consideration in the transaction.

Deficient Feeding-Stuffs.

The quality of the feeding-stuffs supplied is far inferior to that of the manures. In few instances do they quite come up to their guarantees; and out of a total of 27 originally recorded, 5 were found so deficient that the Committee found it necessary to inquire into the circumstances of each case. It was resolved that 2 of these might be permitted to drop, but that the details of the 3 others should be published. It was found, however, that the Society's regulations in the interest of the sellers had not been rigidly adhered to, and the association asked leave to withdraw them and forego the grant in respect of them.

These cases of deficiency in 1889 convey two lessons which it is hoped will not be lost sight of by members of analytical associations: 1st, That they need hope for no assistance from the Society unless its regulations, drawn up in the interest of both buyer and seller, have been carefully complied with; and 2d, That at the present time it is necessary to have feeding-stuffs analysed even more frequently than manures.

Phosphate Fish-bone Guano.

A substance sold under the above fourfold name has found its way across the Border. Agents have been appointed for the sale of it, and they have been supplied with printed circulars setting forth the extraordinary virtues of this wonderful new material. It is said to be manufactured by a company who are "opening out a new industry on the coasts of the great sea fisheries," and who describe it as a *very powerful and cheap guano*, equal to farmyard manure in its efficacy as a manure for root crops, and superior to nitrate of soda as a top-dressing for grass. Moreover, it is a "production from the sea," and contains what are called "saline salts," which eradicate all moss, and destroy the "larvæ and germs of ground grubs, slugs, and all insect life, thereby ridding the land of these pests;" and it is a certain cure for smut, blight, and light grain. It is to be had for £3, 10s. per ton delivered; and farmers who want it had better be quick, for the company can't promise to supply more than 60,000 tons this season.

This quadruplex manure is guaranteed to contain from 2¼ to 2½ ammonia, and from 14 to 17 per cent phosphate, and to be "rich in potash, soda, and other alkaline salts." Should any delivery be found deficient, the company will be glad to take it back on condition that the sampling has been done in a certain way in their presence; and they will pay the cost of analysis on condition that the analysis was made by one or other of two specified chemists.

Two samples have been sent to me by members of the Society. No. 1 is a sample received from an agent before purchase, and No. 2 was taken from a small quantity that had been purchased through a local agent.

	No. 1.	No. 2.
Phosphoric acid (insoluble) . .	1.79	0.73
Ammonia	1.49	0.64
Potash	0.16	0.26
Sand	64.45	89.38

This "phosphate fish-bone guano" is seen to contain a mere sprinkling of phosphate. It is derived, in part at least, from fish offal, for the stuff has a powerful smell of rotten fish, and this is the only respect in which it may be called "powerful." There will doubtless be some bony material in the fish-scrap, but it is not a guano. About nine-tenths of it is sand, and therefore it may well be described as a "production from the sea"; and considering how abundant that substance is, not only "on the coasts of the great sea fisheries," but almost everywhere else, it cannot be for want of raw material that this patriotic company are unable to supply more than 60,000 tons of it this season. The other ingredients, in the small proportion required, can be had even more conveniently than the sand. Insoluble phosphate is cheap and plentiful, and so is ammonia, from even the best sources; the "saline salts rich in potash," in the quantity required, do not need to be specially provided; while a smell, very powerful and penetrating, can be produced at a trifling cost. There seems to be no reason why the company should not be able to supply 600,000 tons this season, except the difficulty of finding purchasers.

That will be an insuperable difficulty if farmers, before investing in such substances, would take the precaution of having them analysed. The analyses of such samples of this substance as have come under the notice of the Chemical Committee prove to them that the so-called guano is just what they would expect it to be from the extravagant and ridiculous terms of its advertisement, and they have thought it a duty to publish the analysis of the stuff, so that members who may be tempted to invest in it may be put upon their guard.

EPIZOOTIC ABORTION.

By J. M'FADYEAN, M.B., B.Sc., F.R.S.E., Royal Veterinary College, Edinburgh.

THE evidence that there is a contagious disease of pregnant cows, having abortion for its essential symptom, may be said to be of three sorts:—

1. The inadequacy of other assigned causes of abortion to account for the present alarming prevalence of the disease.
2. Experimental and clinical evidence directly pointing to the transmissibility of the disease after the manner of well-known infectious maladies.
3. The success which has attended lines of treatment based upon the supposition that the disease is contagious.

1. *Inadequacy of the commonly assigned causes to account for the present prevalence of abortion.*—In order to show the inadequacy of other assigned causes than contagion to account for the present prevalence of abortion among cows, it will be necessary to devote a short space to enumerating the conditions which have been regarded as playing the part of excitants of abortion on a large scale. In this connection it is obviously unnecessary to discuss such agencies as direct mechanical injury, fright, over-exertion, or the existence of severe general disease on the part of the mother. These are on all hands admitted to be capable of bringing about abortion; but where they are in operation the fact can hardly escape observation.

"*Sympathy.*"—A theory which at one time was very generally accepted as an explanation of the occurrence of a large number of cases of abortion in the same herd, was the so-called "sympathy" theory. This assumed that when one cow aborted, the other pregnant cows in the same herd or building were prompted to follow suit by the mere knowledge that one of their companions had been in labour. Regarding this theory nothing more need be said than that it may well occasion surprise that it ever was accepted. Nevertheless it reigned to a considerable extent, not only in this country but also on the Continent; and it may be laid to its charge that it did much harm by its obvious tendency to stifle inquiry regarding the actual causes of abortion.

Errors in diet.—Under this heading there fall to be mentioned certain improprieties in feeding which are undoubtedly occasional causes of abortion. Such are engorgement with green food or roots, leading to the generation of gas in the stomachs, with consequent pressure on the womb, and interference with the circulation of blood in that organ. The drinking of large quantities of ice-cold water, and the eating of frozen roots, are probably also the cause of isolated cases of abortion. Such agencies as these, however, cannot seriously be brought forward as capable of accounting for the occurrence of abortion on a large scale.

Allied to these errors of diet, but more important in the present connection, is the use of such unwholesome food as mouldy hay or straw, or unsound turnips or potatoes. It is impossible to deny that these may occasionally be the cause of what, from the number of cows attacked, might be called an outbreak of abortion, since large quantities of unsound fodder and roots are not rarely given to cows, and sometimes, indeed, form their sole diet for considerable periods. At the same time, it must be admitted that there are on record exceedingly few cases in which the clear proof was furnished that the abortion was really ascribable to bad food of the nature specified. Too frequently the opinion has been hastily formed that these errors in diet constituted the actual cause of the disease, because it was found that such errors were being committed. It need hardly be said that where the abortion is laid to the charge of misfeeding, there is a very simple test of the correctness of the opinion—viz., to change the diet; for the cause being removed, the abortion ought then, or at least soon thereafter, to stop.

Nothing was more clearly brought out by the information furnished to the Highland and Agricultural Society's Committee of Inquiry on this subject, than that it was quite impossible to account for any considerable proportion of the outbreaks brought under their notice by assuming that the diet was the essential factor. Indeed, in not a single outbreak was the food of such an unwholesome character as to suggest that it might be at the root of the trouble. If any further evidence of the insufficiency of this frequently assigned cause were required, it would be found in the fact that abortion may occur as a plague in one farm out of a great many in which the system of feeding, housing, and management is substantially uniform, and that in the same stock the disease manifests itself when the cows are at grass, as well as when they are house-fed on roots and dry fodder.

Ergot.—Nearly related to the subject of unwholesome food of the kind just considered, is that of ergotised grasses. Until recently, the view that most instances of abortion on a large scale were due to the eating of ergotted grass or hay, may be said to have vied with the sympathy theory for supremacy. It would, however, be unfair to class together the two theories as of equal respectability, for the view that ergot is accountable for a great deal of abortion rests upon very reliable evidence.

Finlay Dun, in his standard work on 'Veterinary Medicines,' says: "Abortion from eating ergotted grasses occurs amongst cows, ewes, and deer in many grass districts of England and Ireland, especially in wet seasons. The hay from pastures subject to ergot is seldom, however, so injurious as the grass, for it is generally cut before the fungus is matured. Cows abort from this cause more frequently than ewes or deer, for they are more prone to eat the coarser, longer ergotted grasses, and moreover are often pregnant in the later months of summer when ergot occurs. Experimentally, abortion has been produced in guinea-pigs, cows, bitches, cats, sows, and ewes, and even in rabbits (Stille's 'Therapeutics'). Youatt declared that he had never known ergot fail in its action on the pregnant uterus either of monogastrics or of ruminants. The negative results obtained by some experimenters are doubtless explained by their having used the drug or its preparations, which have been spoilt frequently by keeping."

Without casting any doubt upon the accuracy of the statements contained in the above quotation, it is still possible to hold that of the abortion which at the present time is rampant in Scotland no important proportion can be set down to the use of ergotted grass or hay. To prove that, the following facts will suffice—(1) In the great majority of the outbreaks brought under the notice of the Society's Committee of Inquiry, 90 per cent of the cases of abortion occurred during the winter months, and therefore could not have been due to ergotted grasses. (2) In no case investigated by the committee could ergot be found in the hay, where that formed part of the diet. (3) In many cases the cows, at the period when most of the cases of abortion occurred, were not receiving any hay, but, in place of that, solely oat-straw. (4) The manner in which the abortion occurred—the train of symptoms preceding the act—suggested the operation of some cause quite different from ergot.

On these grounds it therefore seems impossible to regard ergot as playing any important part in the causation of abortion among cows—in Scotland at least.

Various other substances have by different authors been regarded as the cause of occasional outbreaks of abortion. Thus Professor Zurn,[1] of the University of Leipzig, accuses large quantities of common salt, and feeding with cakes composed of palm-nut or earth-nut meal, of having in his experience caused abortion among cows. Such opinions, even admitting their correctness in particular cases, have obviously not more than a passing interest when the cause of the widespread abortion now existing in this country is the subject of discussion.

An irrational system of breeding and feeding.—Over-feeding, close breeding, and breeding from animals not arrived at maturity, have been accused of acting as predisposing causes of abortion,—indeed inbreeding has been by some regarded as in itself an efficient cause of abortion. No very weighty or direct evidence in support of this contention, however, has been brought forward, the advocates of such views generally confining themselves to generalisations regarding the weakening of constitution and loss of vigour which too close mating is apt to entail in the offspring, and from these inferring that inability to carry the young to full term may be one of the injurious effects. It cannot be denied that abortion has been a frequent cause of loss in many of our pedigree stocks, but it is equally certain that it is just as common in herds where there is no suspicion of close breeding. When any one feels disposed to build up a theory accounting for this or any other disease on the ground of inbreeding, he would do well to reflect upon the complete overthrow experienced by just such a theory with reference to tuberculosis. Until quite recently veterinary surgeons professed to find in the irrational mode of breeding and feeding animals a perfectly adequate cause of that disease, and yet we now know that there is but one efficient cause of tuberculosis —viz., the entrance into the animal's body of the specific germ.

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[1] Die Schmarotzer auf und in dem Körper unserer Haussäugethiere.

Irrational mating of breeding animals and irrational overfeeding of milch cows may play some part in the production of abortion by weakening the constitution, and thus rendering it more sensitive to the action of the essential cause of the disease; but a greater *rôle* than that we are not warranted in ascribing to them.

2. *Clinical and experimental evidence directly pointing to the contagious nature of abortion.*—The clinical evidence regarding the contagious character of abortion, it must be admitted, is not quite conclusive. Clinical facts are of themselves sufficient to establish the transmissible nature of most contagious diseases of man and animals. In the case, for example, of scarlatina or measles of the human subject, or cattle-plague or foot-and-mouth disease of cattle, no experimental evidence is required to convince us that the disease spreads by contagion or infection. The mere observation of the maladies as they naturally present themselves, forces us to conclude that they are disseminated by contact of diseased with healthy subjects. Nevertheless, it is important to remember that the contagious nature of certain diseases for a long time escaped observation. For example, at the present day it is generally admitted that consumption of the human subject is to a certain extent a contagious disease; but only a few years ago that disease and the corresponding affection of the lower animals were regarded as eminently sporadic.

These considerations may serve to show that a disease may be truly contagious, and yet the truth of its transmissibility may be difficult so long as the evidence is drawn solely from observation of the disease as it naturally occurs. The proof is always easy where what is called "the period of incubation" is short—that is, where decided symptoms are exhibited soon after exposure to infection, and when recovery is prompt. Conversely, it is always difficult to prove contagion where the period of incubation is long, and where the disease runs a slow course unattended with any very decided symptoms. Pleuro-pneumonia may be cited as an example of the latter case. An animal may not show any symptoms for many weeks after the virus of pleuro-pneumonia has entered its system, and hence, by the time that the disease is manifested in it, the circumstances under which it contracted the disease may be difficult to trace. Again, a cow or an ox may be the subject of pleuro-pneumonia, and yet to casual observation appear healthy. Such an animal might spread the disease in a herd and yet escape observation, and hence it might seem as if in that case the disease had broken out in the herd in a sporadic manner—that is to say, independently of contagion.

In like manner it may well be the case that the disease of which abortion is but the chief symptom, is a contagious disease with a rather long period of incubation, and with, in many cases, a latent and yet infective period after abortion. If it be conceded that the disease may be contagious, and that cows may have the power to spread the virus for a considerable period, possibly for months, after they have themselves aborted, then the present prevalence of abortion in our dairy stocks could easily be accounted for.

There is very little positive and unambiguous evidence *extant* pointing to the spread of abortion by traffic in diseased cows—that is to say, by the introduction of cows that had aborted into a previously healthy stock. A near approach to evidence of that kind is found in a case recorded by the German professor Franck, who narrates that a bull which had served a number of aborted cows was subsequently put to four other cows from previously healthy herds, with the result that each of these cows aborted.

The clinical evidence, as has already been said, is thus weak; but that by no means renders it impossible, or even improbable, that the disease really spreads by contagion.

But if a cow that has recently aborted is capable of infecting her neighbours with some disease that will in them also culminate in abortion, it ought to be possible to obtain evidence of the fact by experiment. Franck, whose name has been mentioned above, appears to have been the first to seek for experimental evidence on this point.[1] He surmised that the virus of the disease was contained in the discharge from the genital passages of the aborted cows, or in the remnant of retained cleansing; and he therefore introduced such matter into the genital organs of a sound pregnant cow, with the result that the animal subsequently aborted.

The Society's Committee of Inquiry carried out eight experiments designed to elicit evidence regarding the transmissibility or non-transmissibility of abortion. In two of these experiments the cows were subjected to simple cohabitation with animals that had previously aborted, and in both cases the result was negative. In the remaining six experiments (two cows and four ewes) mucus from the genital passages of aborted cows was introduced into the vagina or injected beneath the skin of the vulva, and a premature birth resulted in all the cases save one (a ewe).

Veterinary Surgeon Bräuer[2] of Annaberg conducted similar experiments, and found (1) that the vaginal mucus, the contents of the water-bag, and the cleansing of cows that had aborted contained organisms; (2) that when the vaginal mucus of cows that had aborted was conveyed into the genital passages of sound pregnant cows, the latter always aborted within from nine to twenty-one days.

Lehnert[3] carried out identical experiments in the case of two cows, and with the same successful result. It may be mentioned that he also reported a case in which the disease was believed to have been spread by the agency of a milker.

Experiments of a like nature were also made in Holland, the result being the same as in the precited cases.[4]

As evidence of a somewhat different character, I may here quote an interesting observation made in 1872 by Dr Johne, the eminent veterinary pathologist of the Dresden Veterinary College. This referred to an outbreak in a byre in which the cows stood in two rows with their heads towards a central gangway. Behind each row there was the usual gutter for the reception of the animals' dung and the flow of the urine, and the two gutters were connected by a cross channel at one end of the byre. The fall for the urine was very slight, and the cows in lying down habitually fouled their hind-quarters in consequence. The evil began with the cow standing at the top of one of the rows, and in this animal the afterbirth was retained. With intervals of one or several weeks, each cow in that row subsequently aborted, the last cow to abort being the animal at the bottom of the series. After this the disease began at the bottom of the other row, and travelled up it until all the cows had aborted. The conclusion drawn from these facts was, that the virus contained in the discharge from the aborted cow or in the retained cleansing found its way into the gutter, and that each cow received the infection by fouling her external genitals while lying down in the stagnant urine.

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[1] Zeitschrift Tierarzt, 1872.

[2] Zurn, *loc. cit.*

[3] Bericht über das Veterinärwesen in Königreich Sachsen, 1878.

[4] Schneidemühl's Thiermedizinische Vorträge, 1889.

It cannot be denied that the observations and experiments which have just been summarised, although they are not sufficient to establish the contagious character of abortion, certainly point in that direction. They appear to show that there is present in the genital passages of cows that have recently aborted a something which, when it is introduced into the vagina of sound pregnant cows, is capable of bringing about abortion in the latter. It is scarcely necessary to say that no such property is possessed by the vaginal mucus or discharges from cows that are healthy and have carried to full term. It ought to be observed that it is not simply a case of inoculating with putrid matters, for in nearly every case of epizootic abortion there is a marked absence of putridity in the fœtus and in the vaginal discharges immediately after the act of abortion. The subsequent offensive odour is a mere accident, depending upon the growth and multiplication of the everywhere-present germs of putrefaction in the retained cleansing. When abortion occurs during the first three or four months of pregnancy, the fœtus and its envelopes (the latter constituting the so-called "cleansing") are expelled together, and in these cases the subsequent discharge is as free from putrid odour as that of recently calved healthy cows. If any further evidence on this point were required, it would suffice to point out that cases of retained and putrefying placenta or cleansing occur now and again in every herd without leading to abortion in the other cows of the stock.

Another point worthy of attention in connection with the result of the precited experiments, is that the abortion never occurred immediately after the attempt to infect. If abortion had occurred within a few hours, or even a few days, after the introduction of the vaginal mucus (whether by means of a cotton-wool plug or by subcutaneous injection), there might have been some reason to suspect that possibly the result was ascribable to the mechanical effect of the operation, or to some chemical irritant in the substances introduced; but it is impossible to account in that way for abortion setting in some weeks after the operation. On the other hand, if we suppose that the abortion which resulted in these experiments was due to some specific germ transferred from the diseased to the healthy cows, the period that elapsed between the attempt to infect and the act of abortion would be naturally explained as the period of incubation—that is to say, the period during which the virus was at work in the womb of the cow before any symptom of its presence was discoverable.

To say that a disease is contagious or infectious is now admitted to be equivalent to stating that it is caused by some living germ, which reproduces itself in the system of the diseased animal, and which in reality constitutes what in more vague terms is called the "virus" of the disease. In a number of animal diseases the absolute proof of their micro-parasitic nature has been furnished (1) by finding the germs in the bodies of animals dead of the natural disease; (2) by growing these germs artificially on substances outside of the animal body; and (3) by inoculating or otherwise introducing these cultivated germs into the body of healthy animals, and thereby setting up an attack identical with a case of the disease as it occurs naturally. Attempts have been made to do this in the case of abortion, but as yet without complete success.

Nearly twenty years ago Franck drew attention to the occurrence of minute germs in the discharges from cows that had aborted, but that can hardly be cited as an observation in any way proving that abortion is contagious. At the present day it is well known that germs are constantly to be found in the soil, in the water that we drink, and in all animal fluids to which the atmospheric air has access. With few exceptions these germs are not possessed of any disease-producing power, and hence it will readily be understood that the mere observation that micro-organisms are present in diseased tissues or discharges affords no proof that these micro-organisms have the least causal importance.

The Society's Committee of Inquiry paid particular attention to this subject, and by using modern methods of isolating and cultivating micro-organisms, they were able to identify several distinct species in the mucus from cows that had recently aborted. Possibly one of these is the specific germ of abortion, but that can only be proved by testing the effect of each species when pure cultures of it are introduced into the genital passages of healthy pregnant cows.

Professor Nocard, the Director of the Veterinary College at Alfort, near Paris, who at the instance of the French Agricultural Department carried out a series of investigations regarding the cause of abortion in cows, found a germ in large numbers between the womb and the fœtal membranes of cows that aborted. The germ was also found in the alimentary canal of calves that had been aborted, while it was never found in the womb after a normal parturition, or in calves born healthy and at full term. Professor Nocard believes that this is probably the causal parasite of abortion, but he has not yet been able to excite abortion experimentally by introducing it into the genital passages of pregnant cows.[1]

To sum up the whole of our knowledge upon this head, it may be said that there has already been produced a respectable body of evidence, not amounting to actual proof, that the spread of abortion among cows depends upon a *contagium vivum* discharged from the genital passages of cows that have aborted. Further experiment is required to place the matter beyond doubt, and it is earnestly to be hoped that such experiments will soon be carried out. To prove that the widespread abortion in cows is merely the symptom of a contagious disease the essence of which is a micro-organism inhabiting the womb of the cow before and after the act of abortion, would be a most important step towards arresting the plague. That the matter can be absolutely settled by experiment does not admit of any doubt. Time and a considerable sum of money would, from the nature of the case, be required to carry out the necessary experiments; but even a very large sum of money would be well spent if it set this matter at rest. If abortion is contagious, then it is at present being very supinely treated, and it will ere long become even a more formidable plague than it now is. If, on the other hand, it is not contagious, then it is high time that the minds of stock-owners and veterinary surgeons should be disabused of the notion that it probably is, in order that attention may be turned to other possible causes.

The lines along which future investigations ought to proceed are these:—

(1) To repeat, on a larger scale, attempts to excite abortion by introducing into the genital passages of healthy cows either mucus from aborted cows or pure cultures of micro-organisms isolated from such mucus.

(2) To investigate the structural alterations which in all probability exist in the womb of the cow, or in the fœtus or its envelopes, in cases of abortion. With this object it would be necessary to kill a number of cows immediately after the act of abortion.

(3) To discover what germs, if any, are actually present in the womb before or at the moment of abortion. This again would demand the sacrifice of cows just aborted or in which the act is impending.

(4) To ascertain the state of the womb as regards its structure, and the presence of germs in it at a certain period after abortion.

3. *Success of antiseptic or germicidal methods of treating abortion.*—There are now available a considerable number of reports bearing upon the treatment of outbreaks of abortion by means

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[1] Private Report.

devised to destroy the hypothetical germ of the disease. This treatment may be said to resolve itself into two operations,—viz., (1) to attack the germs at the fountain-head—that is, within the body of the diseased cow which is supposed to breed and disseminate them; (2) to attempt to destroy them after they have been discharged from the diseased cow, and before they obtain a foothold in the healthy cows exposed to the infection. In most cases these operations have been simultaneously carried out, and in general, it is said, with conspicuous success.

Professor Nocard reports that the following system of treatment has led to the suppression of the disease in eleven herds in which it had prevailed for years.[1]

A. Once a-week the floor of the byre is to be scraped, thoroughly swept, and watered with a solution of sulphate of copper (blue vitriol) of the strength of 40 grammes to the litre of water (about 17 grains to the ounce).

B. The individual treatment of the cows is more complex :—

1. At the outset, the full of a large injection-syringe of the following solution is to be vigorously injected into the vagina of each cow :—

	Parts (by weight).
Distilled water (rain-water may be used) .	4000
Glycerine and alcohol, of each . . .	10
Bichloride of mercury (sublimate) . .	1

(Dissolve the bichloride of mercury in the alcohol and glycerine, add this to the water, and agitate the whole strongly. This solution ought to be kept in a wooden vessel, such as a barrel or bucket, and placed out of reach of children and animals.)

2. Each morning, when the cows are being cleaned, the vulva, anus, and lower face of the tail of each are to be carefully washed with a sponge dipped in the above solution.

3. Finally, when a case of abortion occurs, it is necessary—*a*, to immediately deliver the cow with the hand; *b*, to destroy immediately by fire or boiling water the fœtus and its envelopes; *c*, to irrigate the uterine cavity with 8-10 litres (about 1½ gallon) of the above liquid, by the aid of a long caoutchouc tube introduced into the organ.

4. It is unnecessary to say that these important and delicate manipulations must be entrusted to a veterinary surgeon.

The intra-vaginal or intra-uterine injection always provokes, especially in young cows, expulsive efforts calculated to excite alarm, but which are in reality without danger.

The vaginal injection at the outset is indispensable in order to destroy the contagion, which may already have penetrated there.

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[1] Recueil de Médecine Vétérinaire, June 1888.

The daily washings have for object to prevent its penetration, if that has not already taken place.

The cows in which the contagion has already gained the uterine cavity cannot be preserved, and hence the treatment does not produce entirely its good effects until the second year; during the first there are always some cases of abortion, but they are much less numerous.

A somewhat different mode of treatment has been favourably reported upon by a considerable number of German veterinary surgeons and stock-owners. This consists in a careful disinfection of the floor, the vulva, anus, and root of the tail, and the practice of vaginal injections, as in Professor Nocard's method, save that a solution of carbolic acid is used instead of the corrosive sublimate. But over and above that, each cow between the fifth and seventh months of pregnancy receives once a fortnight a subcutaneous injection (under the skin of the flank) of 1 to 2½ drachms of a 2 per cent solution of carbolic acid. This is supposed to form a very important part in the treatment. If, as there seems no reason to doubt, these germicidal methods of treatment are attended by a large measure of success, it is probable that the greater share of that must be placed to the credit of what may be called the external disinfection. In other words, it is probably of much greater importance to thoroughly disinfect the floor and the discharges from the cows, than to attempt to destroy the germs while they are lodged within the womb of the cows that have aborted. In confirmation of this view, it may be mentioned that a German stock-owner reports that he obtained very favourable results by diligently carrying out Professor Nocard's line of treatment without the vaginal injections. He strongly counsels, however, the early sale to the butcher of every cow that has aborted.[1]

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[1] Schneidemuhl, *loc. cit.*

APPENDIX (A).

PROCEEDINGS AT BOARD MEETINGS.

MEETING OF DIRECTORS, 6TH FEBRUARY 1889.

Present.—*Vice-Presidents*—The Earl of Haddington in the chair; Mr Martin of Auchendennan; Mr Walker, Portlethen. *Ordinary Directors*—Hon. R. Baillie Hamilton of Langton; Mr Fisher, Jellyholm; Mr Cran, Kirkton; Mr Milne, Inverurie; Sir Robert Menzies of Menzies, Bart.; Mr Buttar, Corston; Mr Stirling of Kippendavie; Mr Macpherson Grant of Drumduan; Mr Glendinning, Hatton Mains; Mr Mackenzie, Dalmore; Sir Jas. H. Gibson-Craig of Riccarton, Bart.; Mr Marr, Cairnbrogie; Rev. John Gillespie, Mouswald; Mr Macduff of Bonhard; Mr Turner, The Dean; Mr Ballingall, Dunbog; Mr Ford, Fentonbarns; Mr Maxwell, yr. of Munches; Mr Shirra Gibb, Boon. *Extraordinary Directors*—Mr Elliot, Hollybush; Mr Usher, Courthill; Mr Scott Plummer of Sunderland Hall; Mr Gilmour of Montrave; Mr Villiers of Closeburn Hall; Mr M'Queen of Crofts; Mr Middleton, Clay of Allan; Mr Elliot of Wolfelee. *Hon. Secretary*—Sir G. Graham Montgomery, Bart. *Chairman of Committee*—Mr Dundas of Arniston. *Chemist*—Dr A. P. Aitken. *Auditor*—Mr Wm. Home Cook, C.A. *Engineer*—Mr James D. Park.

Apologies were reported for the absence of Sir Geo. Houstoun Boswall, Bart.; Mr Allan, Munnoch; Mr Dudgeon, yr. of Cargen; Mr Elliot of Clifton Park; Mr Elliot, Blackhaugh; Mr Hewetson, Auchenbainzie; Mr Howatson of Glenbuck; Mr Irvine of Drum; Mr Lumsden of Balmedie; Mr Mackenzie of Portmore; Mr Murdoch, Gartcraig; and Mr Park, Dechmont.

NOMINATION OF JUDGES.

This question came again before the Board upon a remit from the General Meeting of the Society. Mr VILLIERS moved—"That this Board ratify the finding of the late Board adopting the resolution of the Joint Committee as to the appointment of judges for one year." This was seconded by Mr GILLESPIE. Sir ROBERT MENZIES moved that the Board continue to appoint the judges as heretofore, with the alteration that there should be no non-Directors on the General Show Committee. Mr MARTIN, Auchendennan, seconded. After a lengthened discussion, which was taken part in by Mr Villiers, the Chairman, Mr Stirling, Mr Walker, Mr Gillespie, Sir James Gibson-Craig, Mr Dundas of Arniston, Mr Mackenzie, Dalmore; Mr Maxwell, yr. of Munches; Sir Graham Montgomery, and Mr Fisher, Mr STIRLING moved that the appointment of judges be left to the Directors. Mr ELLIOT of Wolfelee seconded. Sir Robert Menzies withdrew his motion in favour of Mr Stirling's, and on a vote being taken between Mr Stirling's amendment and Mr Villiers' motion, the latter was carried by a majority of 13 to 12. Four members declined to vote.

MELROSE SHOW.

As it appeared to the Directors that the districts in which half-bred sheep chiefly existed were not unanimous as to the name that should be given to the half-bred sheep, they determined for this year that they should be exhibited under their old name of half-breds. Lord Polwarth was unanimously appointed Convener of the Local Committee for the Melrose Show.

CHEMICAL DEPARTMENT AND MARGARINE CHEESE.

Remits from the General Meeting regarding the Chemical Department and margarine cheese were postponed till the new Standing Committees had been appointed.

ORDNANCE SURVEY.

A memorial to the Surveyor-General of the Ordnance Survey, as resolved upon at the General Meeting, was brought up, approved of, and signed by the Chairman.

HERIOT-WATT COLLEGE.

The following motion, by Mr ELLIOT of Wolfelee, was negatived on a division:—"That the rule of the Society forbidding the giving of fresh grants of money be rescinded to the extent that the Society should grant to the Heriot-Watt College the same support that is given to the Technical College, Glasgow."

COMMITTEES FOR 1889.

On the motion of Sir JAMES GIBSON-CRAIG these Committees were rearranged, and the number reduced from 17 to 9. The naming of the members of these Committees was postponed till next meeting.

BINDING 'TRANSACTIONS.'

The estimate of G. Duncan & Son for binding the 'Transactions' was accepted.

PLOUGHING MATCHES.

The SECRETARY reported that the Kintyre Agricultural Association had allowed fifteen hours for ploughing an acre of land, which, according to the regulation of the Society, should be done in ten hours. The Directors considered that it was a great waste of time allowing fifteen hours, and resolved to adhere to their regulation.

PRESENTATION.

The SECRETARY was instructed to thank Mr Curtis, London, for two books presented by him to the Society—viz., 'Estate Management' and 'Practical Forestry.'

MEETING OF DIRECTORS, 6TH MARCH 1889.

Present.—Vice-Presidents—The Earl of Haddington; Mr Walker, Portlethen. *Ordinary Directors*—Hon. R. Baillie Hamilton; Mr Fisher, Jellyholm; Mr Cran Kirkton; Mr Hewetson, Auchenbainzie; Sir Robert Menzies, Bart.; Mr Buttar, Corston; Mr Stirling of Kippendavie; Mr Macpherson Grant of Drumduan; Mr Glendinning, Hatton Mains; Mr Mackenzie, Dalmore; Sir James H. Gibson-Craig, Bart.; Mr Marr, Cairnbrogie; Rev. John Gillespie, Mouswald; Mr Macduff of Bonhard; Sir J. R. Maitland, Bart.; Mr Ballingall, Dunbog; Mr Ford, Fentonbarns; Mr Lumsden of Balmedie; Mr Maxwell, yr. of Munches; and Mr Shirra Gibb, Boon. *Extraordinary Directors*—Mr Mackenzie of Portmore; Mr Elliot, Hollybush; Mr Usher, Courthill; Mr M'Queen of Crofts; Mr Paterson, Plean Farm; Mr Middleton, Clay of Allan; Mr Elliot, Blackhaugh; Mr Villiers of Closeburn Hall; Mr Murdoch, Gartcraig. *Chairmen of Committees*—Dr Cleghorn of Stravithy; Mr Hope, East Barns. *Chemist*—Dr A. P. Aitken. *Auditor*—Mr Wm. Home Cook, C.A. *Engineer*—Mr J. D. Park.

Mr F. N. MENZIES reported apologies for the absence of Sir Graham Montgomery of Stanhope, Bart.; Mr Buchanan, Garscadden Mains; Mr Dudgeon, yr. of Cargen; Mr Elliot of Clifton Park; Mr Forbes of Culloden; Mr Gilmour of Montrave; Mr Martin of Auchendennan.

COMMITTEES FOR 1889.

The Standing Committees for 1889 were reorganised according to the arrangement published in the report of last meeting, and the names will be recorded in the Premium-Book. Mr Irvine of Drum having resigned his chairmanship of the Publications Committee, the following resolution was unanimously adopted: "That Mr Irvine of Drum having presided over the Committee on Publications for a period of 35 years, the Directors deem it due to him that the minutes of the Society should bear a permanent record of the sense which they entertain of his unremitting and valuable services. The Directors therefore resolve that the cordial thanks of the Society be given to Mr Irvine for the important services rendered by him as a Member, a Director, and as Chairman of the Committee on Publications."

AGRICULTURAL AND FORESTRY EXAMINATIONS.

The SECRETARY intimated that the examinations for the Society's certificate and diploma in Agriculture and for the certificate in Forestry had been fixed for the 27th, 28th, and 29th curt., candidates being required to lodge intimation on or before the 18th.

PLEURO-PNEUMONIA.

On the motion of Mr **MAXWELL**, it was unanimously agreed to memorialise the Privy Council to undertake the slaughter of animals affected with pleuro-pneumonia, and to pay compensation out of Imperial funds.

IRISH CATTLE TRAFFIC.

A letter was read from Mr Ernest Clarke, Secretary to the Royal Agricultural Society of England, asking the Directors to join with the Society and the Royal Dublin Society in holding a Conference in London with reference to the conveyance of cattle from Ireland to Great Britain, with the view of ultimately approaching the Privy Council on the subject. After discussion, the Directors appointed Colonel Stirling, Mr Maxwell, yr. of Munches, Rev. Mr Gillespie, and the Secretary, as representatives. The same deputation were instructed to memorialise the Privy Council on the question of the composition of the proposed Board of Agriculture, the compensation for the slaughter of animals affected with pleuro-pneumonia out of Imperial funds, and to wait upon the Board of Trade and lay a memorial before them requesting that the sale of margarine cheese be put under the same regulations as the sale of margarine butter.

MELROSE SHOW.

A letter was read from Lord Polwarth agreeing to act as chairman of the Local Committee of Superintendence. A Forage Committee for the Melrose Show was appointed, and also a Committee to arrange about railway rates, &c.

DUNDEE SHOW IN 1890.

A letter was read from Mr Hay, Town-Clerk of Dundee, in reference to the holding of next year's Show in that city, and intimating that the authorities had got up subscriptions towards the expense of the Show amounting to £1000, and that they expected to add to the sum. The Board resolved to hold the Show at Dundee in 1890. With reference to a letter from Mr Galbraith, Town-Clerk, Stirling, the Directors expressed the view that the decision to hold the Show at Dundee next year did not mean that that city was to be substituted for Stirling.

ORDNANCE SURVEY.

The following is the reply to the Society's memorial adopted at the General Meeting on 23d January:—

"OFFICE OF WORKS,
WHITEHALL PLACE, *27th February* 1889.

"SIR,—The Director of Survey has submitted to the Board your letter of the 7th inst., enclosing a memorial from the Highland and Agricultural Society of Scotland praying for the resurvey on the 1.2500 scale of six Scotch counties which were originally surveyed on the 6-inch scale only. In reply, I am directed by the First Commissioner of her Majesty's Works, &c., to acquaint you that very considerable reductions have been made in the staff of the Ordnance Survey, and that it is therefore necessary to restrict as much as possible the area over which it is to be distributed. In commencing the revision and resurvey it was accordingly considered that the most expeditious and economical mode of working would be to concentrate in one part of the country the whole of the reduced strength of the Department, and that the claims of Lancashire and Yorkshire, where the surveys are from thirty-five to forty-five years old, were greater than those of the six Scotch counties. As regards the suggestion contained in the last paragraph of the memorial, that the resurvey of both countries should be carried out simultaneously, I am to point out that although it would be possible to transfer to Scotland one of the Survey divisions now in Yorkshire, such transfer would not materially expedite the completion of the 1.2500 map of Scotland, and it would inconveniently interfere with the present arrangements to make any change in the existing condition. (Signed) H. W. PRIMROSE."

The **SECRETARY** was instructed to reply to this communication, in terms of a letter suggested by Mr Dundas of Arniston, Convener of the Ordnance Survey Committee, and protesting against the delay in carrying out the survey on the 1.2500-inch scale.

PRESENTATION OF BOOKS.

The following works, presented to the Society's library, were submitted and accepted with thanks: volume xiii. of the 'Polled Herd Book'; volume xi. of the 'Clydesdale Stud Book'; and 'The Best Forage Plants,' fully described and figured by Dr Stebler and Dr Schroter, translated by A. N. M'Alpine, consulting Botanist to the Highland and Agricultural Society.

MEETING OF DIRECTORS, 3D APRIL 1889.

Present.—*Vice-Presidents*—Mr Martin of Auchendennan; Mr Walker, Portlethen. *Ordinary Directors*—Mr Fisher, Jellyholm; Sir Robert Menzies of Menzies, Bart.; Mr Glendinning, Hatton Mains; Mr Dudgeon, yr. of Cargen; Mr Elliot of Clifton Park; Mr Buchanan, Garscadden Mains; Rev. John Gillespie, Mouswald Manse; Mr Macduff of Bonhard; Mr Turner, The Dean; Mr Ballingall, Dunbog; Mr Ford, Fentonbarns; Mr Maxwell, yr. of Munches; Mr Shirra Gibb, Boon. *Extraordinary Directors*—Mr Elliot, Hollybush; Mr Usher, Courthill; Mr M'Queen of Crofts; Mr Gilmour of Montrave; Mr Murdoch, Gartcraig; Mr Allan, Munnoch. *Auditor*—Mr Wm. Home Cook, C.A. *Engineer*—Mr J. D. Park.

Mr F. N. MENZIES reported apologies for the absence of Lord Polwarth; Earl of Haddington; Hon. R. Baillie Hamilton; Sir James Gibson-Craig, Bart.; Mr Buttar, Corston; Mr Cran, Kirkton; Mr Elliot of Wolfelee; Mr Forbes of Culloden; Mr Howatson of Glenbuck; Mr Mackenzie of Portmore; Mr Mackenzie, Dalmore; Mr Middleton, Clay of Allan; Mr Stirling of Kippendavie; Mr Villiers, Closeburn Hall; and Dr Aitken. Mr Walker in the chair.

Before proceeding with the business on the programme, resolutions were unanimously adopted expressing regret at the loss sustained by the death of Mr Geo. Dempster, Ormiston Hall, and Sir Thos. Gladstone of Fasque. Both had been office-bearers of the Society.

MELROSE SHOW, 1889.

Letters to the conveners of the Committees connected with the Show—Berwick, Peebles, Roxburgh, and Selkirk—in regard to the nomination of the Local Committee, were agreed to. Letters were read from the Earl of Southesk offering to present a silver cup to the breeder of the best female animal in the Highland breed of cattle in the Yard. The cup was accepted with thanks.

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

The SECRETARY submitted an account of the celebration of the fiftieth anniversary of the incorporation of the Royal Agricultural Society of England at St James' Palace by command of the Queen, under the presidency of his Royal Highness the Prince of Wales, and a report of the proceedings and speeches at her Majesty's dinner.

RAILWAY RATES.

On the motion of the Rev. JOHN GILLESPIE, it was unanimously resolved to invite, in name of the Highland and Agricultural Society, a Conference of representatives of Agricultural Societies and other bodies connected with Agriculture, to be held in Edinburgh, with a view of determining what action should be taken to lodge objections with the Board of Trade against the classification of maximum rates proposed by the different Railway Companies; further, that the following be appointed a Committee to attend the proposed Conference on Tuesday, 23d April, at 1.50, in the Society's Hall, 3 George IV. Bridge, on behalf of the Highland and Agricultural Society, and generally to deal with the question: Mr Gillespie, Mr Turner, Mr Maxwell, yr. of Munches, Colonel Stirling, Mr Walker, Mr Ballingall, Sir James H. Gibson-Craig, Mr Cran, and Mr Macduff—Mr Walker to be convener.

IRISH CHANNEL TRAFFIC.

The SECRETARY stated that, along with the other delegates from the Society, he attended a Conference in London on 28th March with the Royal Society of England and the Royal Dublin Society, and that, after considerable discussion, resolutions were adopted by the Conference to secure better arrangements for loading cattle at railway stations in Ireland, and also at the wharves; better accommodation on board ship, better ventilation and efficient supervision, and the necessity of more stringently enforcing existing regulations. On the following day these resolutions were laid before the Lord President of the Council. Mr Naper stated the case for the Irish Society, Mr Stirling for the Highland Society, and Mr Jacob Wilson for the Royal Society of England. The President expressed regret at the unavoidable absence of his colleagues, the Secretaries for Scotland and Ireland, and after replying to some of the arguments that had been raised, said that the question was one of great importance, and promised to give the representations careful consideration.

PLEURO-PNEUMONIA.

Mr MAXWELL, yr. of Munches, reported that a deputation had waited on the Lord President of the Council with reference to the proposal that owners of animals slaughtered from being affected with pleuro-pneumonia be paid compensation out of the Imperial funds. He stated that the Lord President of the Council had received them most courteously, but said that there were difficulties with the Treasury. His Lordship would, however, give the matter his careful consideration.

PROPOSED BOARD OF AGRICULTURE.

The Rev. JOHN GILLESPIE reported that the same deputation at the same time had waited on Lord Cranbrook, and stated that although they cordially approved of the proposal to create a Board of Agriculture, they thought that practical agriculturists should be invited either to join it or to form an Auxiliary Committee in connection with it. Lord Cranbrook promised to report to his colleagues the point in the Bill to which attention had been called.

MARGARINE CHEESE.

The Rev. JOHN GILLESPIE reported that the deputation had waited on the President of the Board of Trade, and represented the views of the Society that margarine cheese should be put on the same footing in the eyes of the law as margarine butter. He stated that a deputation from the Home and Foreign Produce Exchange had appeared at the same time, and not only expressed the same views in regard to margarine cheese, but pointed out that the provisions of the Act were not sufficiently carried out with reference to margarine butter. The President stated that the Government would not be able, in the present condition of business, to introduce a Bill this year, but it was suggested that the deputation should try to get their views carried out by a private Bill brought before the House of Commons.

FORESTRY.

The recommendations of the Committee on Forestry were approved of as follows: That steps be taken to urge on the Government the necessity of carrying out the proposals of the Select Committee—namely, that a Board of Forestry should be established by Government, and that the various bodies named to form a portion of the Board should be communicated with.

OLD PASTURE GRASSES.

On the motion of the Rev. JOHN GILLESPIE, it was agreed to vote a sum of not more than £30 towards a botanical investigation of old pastures, and a small Committee was appointed to advise with the Botanist and Secretary in conducting the investigation.

AGRICULTURAL EXAMINATIONS.

The Report of the Agricultural Examinations held on the 27th, 28th, and 29th March was submitted. The number of candidates who presented themselves was fifteen. The examinations resulted in seven passing for the diploma and four for the first-class certificate. A letter was submitted from Mr Christison, W.S., sending proposed amended rules for graduation in Agriculture.

'GALLOWAY HERD BOOK.'

The SECRETARY submitted vol. ix. of the 'Galloway Herd Book,' presented to the Society by the Galloway Cattle Society. The volume was accepted with thanks.

MEETING OF DIRECTORS, 1ST MAY 1889.

Present.—Ordinary Directors—Hon. R. Baillie Hamilton of Langton; Mr Fisher, Jellyholm; Sir Robert Menzies of Menzies, Bart.; Mr Buttar, Corston; Mr Stirling of Kippendavie; Mr Glendinning, Hatton Mains; Mr Dudgeon, yr. of Cargen; Mr Macduff of Bonhard; Sir James R. Maitland of Barnton, Bart.; Mr Ballingall, Dunbog; Mr Gibb, Boon. *Extraordinary Directors*—Sir George Houstoun Boswall of Blackadder, Bart.; Mr Mackenzie of Portmore; Mr M'Queen of Crofts; Mr Middleton, Clay of Allan; Mr Elliot of Wolfelee. *Honorary Secretary*—Sir G. Graham Montgomery, Bart. *Chemist*—Dr A. P. Aitken. *Auditor*—Mr Wm. Home Cook, C.A. *Engineer*—Mr James D. Park. Sir G. Graham Montgomery presided.

Mr F. N. MENZIES reported apologies for the absence of Sir James H. Gibson-Craig, Bart.; Sir Wm. S. Walker, K.C.B.; Mr Cran, Kirkton; Mr Gilmour of Montrave; Rev. John Gillespie; Mr Lang of Broadmeadows; Mr Lumsden of Balmedie; Mr Maxwell, yr. of Munches; Mr Murdoch, Gartcraig; Mr Paterson, Plean Farm; Mr Villiers of Closeburn Hall; and Mr Walker, Portlethen.

Letters were read from Sir John R. Gladstone conveying to the Directors the sincere thanks of Lady Gladstone and himself for the honour they had done to the memory of his late father in recording their appreciation of his services to the Society; and from Mrs Dempster, tendering her acknowledgment of the expression of regret on the death of her husband.

GENERAL MEETING.

The half-yearly General Meeting of the Society, for the election of members and other business, was fixed to be held on Wednesday, 19th June.

MELROSE SHOW, 1889.

The **SECRETARY** stated that the implement entries for this Show would close on the 17th May, and stock, poultry, and dairy produce on 14th June. The following were appointed to act as stewards: Mr Maxwell, yr. of Munches, for horses; Mr Elliot of Wolfelee, for cattle; Mr Howatson of Glenbuck, for sheep, swine, &c.; Mr Elliot, Hollybush, for forage; Mr Middleton, Clay of Allan, and Mr Kerr, Broomhouse, for implements. The headquarters of the Society were fixed to be at the George Hotel, and an agreement with Mr Hamilton was submitted and accepted by the Board. A letter was read from Mr Bennett, Glasgow, Secretary of the Caledonian Apiarian and Entomological Society, intimating that it had been resolved not to have an apiarian exhibition this year at Melrose.

ORDNANCE SURVEY.

The following letter addressed to the Secretary was read:—

"H.M.S. OFFICE OF WORKS,
WHITEHALL PLACE, LONDON, S.W.,
24th April 1889.

"SIR,—With reference to your letter of the 6th ultimo, I am directed by the First Commissioner of her Majesty's Works, &c., to acquaint you, for the information of the Highland and Agricultural Society of Scotland, that the Board are still of opinion that it would not be advisable to detach a division of the Survey from Yorkshire and Lancashire for the purpose of commencing at once the resurvey of the six Scotch counties referred to therein. Such a course would not expedite the completion of the survey of these counties, and the only advantage to be gained by its adoption would be as implied in your letter above mentioned, that it would be an earnest of the intention of the Government to resume survey work in Scotland. Such an earnest has, however, already been provided in the fact that a Survey Office has recently been opened in Edinburgh, with a view to the resumption of operations in the six counties; and the First Commissioner is further willing to give an assurance that so soon as the resurvey of Yorkshire and Lancashire shall have been completed, three divisions of the Survey will be stationed in Scotland, and maintained there continuously until the survey of the six counties is finished. Mr Plunkett trusts that with this assurance the Highland and Agricultural Society of Scotland will be satisfied.—I am, Sir, your obedient servant,
H. W. PRIMROSE.

"The Secretary of the Highland and Agricultural
Society, Edinburgh."

The **SECRETARY** was instructed to express regret at the course adopted by the First Commissioner of her Majesty's Works, and to express the hope that he might see his way to commence the survey of the six counties in Scotland.

RAILWAY RATES.

The **SECRETARY** submitted the report of the Joint Committee on Railway Rates, which has already appeared in the papers, and stated that he had sent circulars to all the local agricultural societies in Scotland requesting them to furnish information with reference to their localities.

EXPERIMENTS IN GRASSES.

The **SECRETARY** reported that Professor M'Alpine, the Society's Botanist, had commenced his investigation of old pasture grasses.

MR HALDANE'S TRUCK ACT AMENDMENT BILL.

The following motion, by Mr **ELLIOT** of Wolfelee, was unanimously adopted: "That this Board is of opinion that the present system of paying farm-servants, partly by money and partly in kind, is in no way analogous to the system aimed at and destroyed by the Truck Acts; and that the Bill introduced by Mr Haldane to apply the Truck Act to this system would be most unwise, and extremely hurtful to the servants, and this Board therefore petitions against the Bill aforesaid."

SECRETARY FOR SCOTLAND.

The SECRETARY was instructed to prepare a memorial to the Prime Minister, requesting that Cabinet rank be conferred upon the Secretary for Scotland.

MEETING OF DIRECTORS, 5TH JUNE 1889.

Present.—*Vice-President*—Mr Martin of Auchendennan in the chair. *Ordinary Directors*—Hon. R. Baillie Hamilton of Langton; Mr Fisher, Jellyholm; Mr Cran, Kirkton; Mr Hewetson, Auchenbainzie; Sir Robert Menzies of Menzies, Bart.; Mr Buttar, Corston; Mr Park, Dechmont; Mr Glendinning, Hatton Mains; Mr Stewart of Coll; Mr Buchanan, Garscadden Mains; Mr Mackenzie, Dalmore; Sir James H. Gibson-Craig of Riccarton, Bart.; Mr Marr, Cairnbrogie; Rev. John Gillespie, Mouswald; Sir James R. Maitland of Barnton, Bart.; Mr Ballingall, Dunbog; Mr Ford, Fentonbarns; Mr Forbes of Culloden; Mr Shirra Gibb, Boon. *Extraordinary Directors*—Sir John A. Hay of Haystoun, Bart.; Mr Elliot, Hollybush; Mr Usher, Courthill; Mr Scott Plummer of Sunderland Hall; Mr M'Queen of Crofts; Mr Paterson, Plean Farm; Mr Gilmour of Montrave; Mr Villiers of Closeburn Hall; Mr Murdoch, Gartcraig; Mr Howatson of Glenbuck; Mr Allan, Munnoch. *Chemist*—Dr Aitken. *Auditor*—Mr Wm. Home Cook, C.A. *Engineer*—Mr J. D. Park.

Mr F. N. MENZIES reported apologies for the absence of Mr Dudgeon, yr. of Cargen; Mr Elliot of Wolfelee; Mr Lumsden of Balmedie; Mr Macduff of Bonhard; Mr Mackenzie of Portmore; Mr Middleton, Clay of Allan; Mr Park, Dechmont; and Mr Walker, Portlethen.

CHEMICAL DEPARTMENT.

The following is the report to come before the General Meeting of the Society on the 19th: 1. That the experiments at Pumpherston Station be continued, at an outlay not exceeding £30 per annum. 2. That the grants to analytical associations be continued. 3. That the district club experiments be continued, at a sum not exceeding £100, to be divided proportionally. 4. That half-fees for analysis to members be continued. 5. That the Chemist of the Society be paid £400 per annum for salary, laboratory expenses, and other outlays, including rent of laboratory.

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

A letter was read from his Royal Highness the Prince of Wales, Acting President, inviting the President, two Directors, and the Secretary to attend the Windsor Show as guests of the Society. Sir James Gibson-Craig, Bart., and Mr M'Queen of Crofts were appointed, with Lord Polwarth and Mr F. N. Menzies, to represent the Society.

MELROSE SHOW.

The SECRETARY reported that the last day of entry for stock was 14th June. With reference to the movement of cattle to and from the Show, the Directors resolved to adopt the same regulations as were enforced at the Glasgow Show last year.

RAILWAY RATES.

Copies of objections lodged with the Board of Trade and with the Scottish Railway Companies were submitted, and on the motion of Mr GILLESPIE, on behalf of Mr MACDUFF, the following motion was agreed to unanimously: "That a sum not exceeding £50 be voted to be used if required in supporting before the Board of Trade the objections lodged with said Board to the classification and schedule of rates under the Railway and Canal Traffic Act, 1878."

NEW MEMBERS.

The SECRETARY intimated that he could receive the names of new members up to the morning of 19th inst.

GENERAL MEETING.

The programme of business to come before the General Meeting on 19th June was arranged.

MEETING OF DIRECTORS, 19TH JUNE 1889.

Present.—Lord Polwarth, *President*, in the chair. *Ordinary Directors*—Mr Fisher, Jellyholm; Mr Cran, Kirkton; Mr Milne, Inverurie; Mr Hewetson, Auchenbainzie; Sir Robert Menzies, Bart.; Mr Buttar, Corston; Mr Park, Dechmont; Mr Glendinning, Hatton Mains; Mr Stewart of Coll; Sir James H. Gibson-Craig, Bart.; Mr Marr, Cairnbrogie; Rev. John Gillespie, Mouswald; Mr Macduff of Bonhard; Sir James R. Maitland, Bart.; Mr Ballingall, Dunbog; Mr Ford, Fentonbarns; Mr Lumsden of Balmedie; Mr Maxwell, yr. of Munches; Mr Shirra Gibb, Boon. *Extraordinary Directors*—Sir George Houstoun Boswall, Bart.; Mr Elliot, Hollybush; Mr M'Queen of Crofts; Mr Elliot, Blackhaugh; Mr Villiers of Closeburn Hall; Mr Murdoch, Gartcraig; Mr Allan, Munnoch. *Chemist*—Dr A. P. Aitken. *Auditor*—Mr Wm. Home Cook, C.A. *Engineer*—Mr James D. Park.

Mr F. N. MENZIES reported apologies for the absence of Mr Dudgeon, yr. of Cargen; Mr Gilmour of Montrave; Mr Mackenzie of Portmore; Mr Stirling of Kippendavie; Mr Turner, The Dean; Mr Walker, Portlethen.

The business had reference principally to the business to come before the General Meeting of this date.

MEETING OF DIRECTORS, 6TH NOVEMBER 1889.

Present.—Lord Polwarth, *President*, in the chair. *Vice-President*—Mr Martin of Auchendennan. *Ordinary Directors*—Mr Fisher, Jellyholm; Mr Milne, Inverurie; Sir Robert Menzies, Bart.; Mr Buttar, Corston; Mr Stirling of Kippendavie; Mr Glendinning, Hatton Mains; Mr Dudgeon, yr. of Cargen; Mr Lorne Stewart of Coll; Mr Buchanan, Garscadden Mains; Mr Mackenzie, Dalmore; Sir James H. Gibson-Craig of Riccarton, Bart.; Mr Marr, Cairnbrogie; Rev. John Gillespie, Mouswald Manse; Mr Macduff of Bonhard; Mr Ballingall, Dunbog; Mr Ford, Fentonbarns; Mr Lumsden of Balmedie; Mr Maxwell, yr. of Munches. *Extraordinary Directors*—Mr Mackenzie of Portmore; Mr Paterson, Plean Farm; Mr Elliot of Wolfelee; Mr Elliot, Blackhaugh; Mr Gilmour of Montrave; Mr Villiers, of Closeburn Hall; Mr Murdoch, Gartcraig; Mr Howatson of Glenbuck. *Chemist*—Dr A. P. Aitken. *Auditor*—Mr Wm. Home Cook, C.A. *Engineer*—Mr James D. Park.

Mr F. N. MENZIES reported apologies for the absence of Sir W. S. Walker, K.C.B.; Mr Allan, Munnoch; Mr Forbes of Culloden; Mr Shirra Gibb, Boon; Mr Turner, The Dean; and Mr Walker, Portlethen.

SIR JACOB WILSON.

A letter was read from Sir Jacob Wilson acknowledging receipt of the resolution passed at the General Meeting of the Society at Melrose, congratulating him on the honour of knighthood recently bestowed upon him, and assuring the Directors that he esteemed this act as an additional compliment.

MELROSE SHOW, 1889.

The awards at the late Show at Melrose were submitted and approved, and the Secretary was instructed to issue the premiums awarded as early as convenient.

DUNDEE SHOW, 1890.

Reports by the Committees on General Shows and Highland Industries, recommending the classes and premiums for the General Show to be held at Dundee in 1890, were under consideration of the Board, and directed to be printed and circulated previous to the meeting of Directors in January. It was resolved to hold the Show at Dundee at the usual time, commencing the last Tuesday in July.

NOMINATION OF DIRECTORS BY SHOW DISTRICTS.

A report by the Secretary was read, showing that the following members had been nominated and recommended to the Board as ordinary Directors in terms of the regulations: *Glasgow District*—Thomas D. Findlay of Easterhill. *Perth District*—John Gilmour of Montrave. *Stirling District*—Donald Fisher, Jellyholm. *Edinburgh District*—R. G. Wardlaw Ramsay of Whitehill. *Aberdeen District*—George Wilken, Waterside of Forbes. *Dumfries District*—James Lockhart, Mains of Airies. *Inverness District*—John Cran, Kirkton. *Border District*—The Master of Polwarth.

OFFICE-BEARERS AND DIRECTORS.

A remit was made to the following Committee to prepare a list of office-bearers and Directors for 1890, and to submit it for consideration to the December meeting: Mr

Elliot, Hollybush; Rev. John Gillespie; Mr Howatson; Mr Park, Dechmont; Mr Elliot of Wolfelee; Mr Lumsden; Sir James Gibson-Craig, Bart.; Mr Gilmour, Mr Macduff, Mr Ballingall, Mr Stirling, Mr Buchanan, Mr Buttar, Mr Mackenzie, Dalmore, and Mr Marr,—Sir James Gibson-Craig, Bart., convener.

BURSARIES.

The report of the examinations for the Society's bursaries was read, and the following gentlemen were found entitled to bursaries of £20 each: (1) James M'Kinnell, Kilmartin, Lochgilphead; (2) John Murray, The Muir, Laurencekirk; (3) William Henderson, 34 Upper Gray Street, Edinburgh.

EXPERIMENTS ON GRASSES.

The minute of Committee was approved, and the experiments which had been conducted by Professor M'Alpine during the summer were considered very satisfactory, and a proposal to continue them till next year was postponed till the January meeting.

MACHINERY.

It was resolved on a minute from the Machinery Committee to offer prizes of £15 and £10 for the best grist-mill, to be exhibited at Dundee Show.

TRANSIT OF CATTLE FROM IRELAND.

It was remitted to a small committee to consider the report of the inspectors of the Privy Council on the transit of cattle from Ireland, and to memorialise the President of the Board of Agriculture on the subject.

DISTRICT SHOWS AND COTTAGES AND GARDENS.

It was remitted to the Committee on District Shows and Cottages and Gardens to revise the awards for 1889, and consider and report on the applications for 1890.

MEETING OF DIRECTORS, 4TH DECEMBER 1889.

Present.—Lord Polwarth, *President*, in the chair. *Vice-Presidents*—Mr Martin of Auchendennan; Mr Walker, Portlethen. *Ordinary Directors*—Mr Fisher, Jellyholm; Mr Milne, Inverurie; Sir Robert Menzies, Bart.; Mr Buttar, Corston; Mr Park, Dechmont; Mr Stirling of Kippendavie; Mr Macpherson Grant of Drumduan; Mr Glendinning, Hatton Mains; Mr Dudgeon, yr. of Cargen; Mr Buchanan, Garscadden Mains; Sir Jas. H. Gibson-Craig, Bart.; Rev. John Gillespie, Mouswald Manse; Mr Macduff of Bonhard; Mr Ballingall, Dunbog; Mr Lumsden of Balmedie; Mr Maxwell, yr. of Munches; Mr Forbes of Culloden; Mr Shirra Gibb, Boon. *Extraordinary Directors*—Mr Usher, Courthill; Mr Scott Plummer of Sunderland Hall; Mr M'Queen of Crofts; Mr Elliot of Wolfelee; Mr Gilmour of Montrave; Mr Murdoch, Gartcraig; Mr Howatson of Glenbuck; Mr Allan, Munnoch. *Honorary Secretary*—Sir G. Graham Montgomery, Bart. *Chemist*—Dr A. P. Aitken. *Auditor*—Mr Wm. Home Cook, C.A. *Engineer*—Mr J. D. Park.

Mr F. N. MENZIES reported apologies for the absence of Sir Wm. S. Walker, K.C.B.; Mr Cran, Kirkton; Mr Elliot, Hollybush; Mr Mackenzie, Dalmore; Mr Middleton, Clay of Allan; Mr Paterson, Plean Farm; and Mr Villiers of Closeburn Hall.

THE LATE MR SMALL KEIR.

Before proceeding to the business on the programme, the Directors, on the motion of Lord Polwarth, resolved to express the deep and sincere regret with which they have received the intimation of the death of Mr Patrick Small Keir of Kindrogan, and their sense of the assistance rendered by him as a member of the Society for 52 years, and as a Director during the years 1871 to 1875.

BOARD AND GENERAL MEETINGS.

The Board Meeting for January 1890 was fixed to be held on the 8th instead of the 1st, and the anniversary General Meeting on the 22d of that month.

AGRICULTURAL AND FORESTRY EDUCATION.

The SECRETARY reported that the examination of candidates for the Society's Agricultural Certificate and Diploma, and for the Certificates in Forestry, had been fixed for the 26th, 27th, and 28th March, candidates being requested to lodge intimation before the 18th March.

SHOWYARD ARRANGEMENTS.

The suggestions of the Committee were carefully considered by the Board, and various items were again remitted to a special Committee to report to the meeting in January.

FORESTRY AND HIGHLAND INDUSTRIES.

A proposal to limit the area for which prizes are offered to the Highlands proper of Scotland was not approved of, and it was remitted back to the Committee to propose prizes for the Dundee Show which would embrace the whole of Scotland.

CHEMICAL DEPARTMENT.

The report of the district experimental associations was submitted, showing that £100 allowed by the Directors had been exhausted in paying for manures and feeding stuffs for the local experimental stations.

VETERINARY AND DAIRY DEPARTMENT.

It was agreed to postpone the trial of the apparatus for testing acidity in milk till the commencement of the cheesemaking season in spring. It was also agreed to carry on the inquiry into abortion in animals, and the Directors agreed to vote £100 for the investigation, provided £200 were subscribed by individuals and local societies. The chairman agreed to subscribe £20, and the following Committee was appointed to raise subscriptions—viz., Lord Polwarth; Sir James Gibson-Craig; Mr M'Queen; Mr Walker, Portlethen; Mr Cran; Mr Mackenzie, Dalmore; Mr Allan; and Mr R. F. Dudgeon, convener.

TRANSIT OF CATTLE FROM IRELAND.

A memorial to the President of the Board of Agriculture which had been prepared by a Committee was postponed for further information previous to being forwarded to the Board of Agriculture.

MEETING OF DIRECTORS, 8TH JANUARY 1890.

Present.—*Vice-President*—Mr Martin of Auchendennan, in the chair. *Ordinary Directors*—Mr Fisher, Jellyholm; Mr Cran, Kirkton; Sir Robert Menzies of Menzies, Bart.; Mr Buttar, Corston; Mr Stirling of Kippendavie; Mr Mackenzie, Dalmore; Sir James Gibson-Craig, Bart.; Mr Marr, Cairnbrogie; Rev. John Gillespie, Mouswald Manse; Mr Macduff of Bonhard; Mr Ballingall, Dunbog; Mr Ford, Fentonbarns; Mr Maxwell, yr. of Munches; Mr Shirra Gibb, Boon. *Extraordinary Directors*—Mr Elliot, Hollybush; Mr Usher, Courthill; Mr M'Queen of Crofts; Mr Middleton, Clay of Allan; Mr Elliot of Wolfelee; Mr Gilmour of Montrave; Mr Howatson of Glenbuck. *Chemist*—Dr A. P. Aitken. *Auditor*—Mr Wm. Home Cook, C.A. *Engineer*—Mr J. D. Park.

Mr F. N. MENZIES reported apologies for the absence of Lord Polwarth; Mr Allan, Munnoch; Mr Dudgeon, yr. of Cargen; Mr Forbes of Culloden; Mr Glendinning, Hatton Mains; Mr Murdoch, Gartcraig; Mr Villiers, Closeburn Hall; and Mr Walker, Portlethen.

THE LATE MR GRAY, SOUTHFIELD.

Before proceeding to the business on the programme, the Directors resolved to express the sincere regret with which they regard the death of Mr William Gray, Southfield, and their sense of the assistance which the Society had on many occasions received from him as a Director and Member of the Society.

THE LATE MR SMALL KEIR OF KINDROGAN.

A letter was read from Mrs Small Keir expressing her grateful thanks to the Directors for the tribute they had paid to the memory of her late husband, and in their recording in the minutes of the Society an expression of deep and sincere regret at his death.

OFFICE-BEARERS.

Acceptances were reported, and the Secretary intimated that the list had been published in yesterday's Edinburgh and Glasgow daily papers.

FINANCE.

Abstracts of the accounts for 1888-89 and state of funds at 30th November were laid before the Directors, and also a statement of income and expenditure for 1888 and 1889 and estimates for 1890.

SHOWYARD MANAGEMENT.

A report of the Committee appointed to consider this subject was submitted and approved—viz., that the Show be managed entirely by a Board consisting of the Secretary and six stewards, these stewards to be elected at the Directors' Meeting in April; and that three foremen be engaged—one for cattle, one for horses, and one for sheep, &c.—to be under the orders of their respective stewards. It was resolved that a rule be added to the prize-list that no rug be hung up to conceal any animal except with the special permission of the steward of the department.

DUNDEE SHOW, 1890.

The premium-list and regulations were submitted and approved, and special premiums by Mr Gilmour of Montrave, Mrs and Miss Morison Duncan of Naughton, and Mr Macpherson Grant were reported, and gratefully accepted. The premium for brood mares with foal at foot was extended so as to admit three-year-old fillies in that condition.

GRASS EXPERIMENTS.

The minute of Committee of 18th December was read to the Board. The Committee recommended that as the investigation had been so very successfully conducted by Mr M'Alpine, the Botanist, it should be continued, and the Society should again give a vote for this purpose, and suggested £50, which was agreed to.

FORESTRY DEPARTMENT.

The following memorial was reported: "Unto the Right Hon. Henry Chaplin, M.P., President of the Board of Agriculture. The memorial of the Highland and Agricultural Society of Scotland showeth: That your memorialists, as representing the landed proprietors and others in Scotland, are much interested in the subject of forestry and the growth of timber as a valuable product. That your memorialists understand that the Board of Forestry is to be a department under the Board of Agriculture. That your memorialists are aware that there is a recommendation by a Parliamentary Committee that a Board of Forestry should be appointed and a School of Forestry established. That your memorialists understand that nothing has as yet been done to carry out that recommendation. Your memorialists would therefore humbly pray that, both in the interests of forestry and the country at large, immediate steps be taken for the formation of a Board of Forestry, and the establishment of Forestry Schools."

ARGYLL NAVAL FUND.

The SECRETARY reported that the Committee in charge of this Fund met on Tuesday last, and appointed Godfrey George Webster, now midshipman on board H.M.S. Swiftsure in the Pacific Squadron, as a recipient from the Fund.

GENERAL MEETING.

The programme of business to come before the General Meeting on January 22d was arranged.

NEW MEMBERS.

The SECRETARY reported that the names of candidates could be received up to the morning of the meeting, January 22d.

MOVEMENT OF LIVE STOCK TO AND FROM MARKETS.

A letter from the Galashiels Farmers' Club was read, suggesting that at the present time, when Railway Companies are trying to obtain parliamentary powers to charge higher rates of carriage for live stock, the attention of agricultural societies should be drawn to the importance of preserving the public right to use the old drove roads and commons, which from disuse and other causes may be in danger of being lost. The Secretary was instructed to express the sympathy of the Board on the subject.

THE LATE MR W. H. WAKEFIELD, OF SEDGWICK, KENDAL.

On the motion of Sir JAS. GIBSON-CRAIG, it was unanimously resolved to record in the minutes of the Society deep regret at the loss the Royal Agricultural Society of England has sustained by the death of Mr Wakefield, their senior steward, and who on the occasion of the Windsor Show had been appointed to entertain the deputation of the Highland and Agricultural Society of Scotland and the Royal Agricultural Society of Ireland, and had done so with the greatest urbanity and kindness.

MEETING OF DIRECTORS, 22D JANUARY 1890.

Present. — *Vice-President* — The Earl of Haddington in the chair. *Ordinary Directors*—Donald Fisher, Jellyholm; Sir Robert Menzies of Menzies, Bart.; Mr Buttar, Corston; Mr Stirling of Kippendavie; Mr Glendinning, Hatton Mains; Mr Macduff of Bonhard; Mr Ballingall, Dunbog; Mr Ford, Fentonbarns; Mr R. Shirra Gibb, Boon. *Extraordinary Directors*—Mr Mackenzie of Portmore; Mr Elliot, Blackhaugh; Mr Murdoch, Gartcraig; Mr Howatson of Glenbuck; and Mr Allan, Munnoch. *Chemist*—Dr A. P. Aitken. *Auditor*—Mr Wm. Home Cook, C.A. *Engineer*—Mr J. D. Park.

Mr F. N. MENZIES reported apologies for the absence of Lord Polwarth; Sir G. Graham Montgomery, Bart.; Mr M'Queen of Crofts; Mr Middleton, Clay of Allan; Mr Walker, Portlethen; Mr Martin of Auchendennan; Mr Cran, Kirkton; Mr Dudgeon, yr. of Cargen; Mr Elliot of Wolfelee; Rev. John Gillespie, Mouswald Manse; Mr Gilmour of Montrave; Mr Maxwell, yr. of Munches; Mr Milne, Inverurie; Mr Park, Dechmont; Mr Villiers of Closeburn Hall.

THE LATE SIR EDWARD COLEBROOKE, BART.

Before proceeding with the business on the programme, the Directors instructed the Secretary to record in the minutes an expression of their sincere regret at the death of Sir Edward Colebrooke of Crawford, Bart., who had on various occasions filled the office of Extraordinary Director, and their sense of the assistance rendered by him as a Member of the Society for 52 years.

The other business had reference principally to the subjects to be brought before the General Meeting of this date.

PROCEEDINGS AT GENERAL MEETINGS.

GENERAL MEETING, 19TH JUNE 1889.

LORD POLWARTH, President of the Society, in the Chair.

In opening the proceedings, LORD POLWARTH expressed his acknowledgments to the Society for having elected him to the chair. He felt there was no industry in our country which was of more vital importance to the welfare of the whole community than agriculture, and he cordially and heartily supported the work which was being carried on.

NEW MEMBERS.

Sixty-two candidates for admission as members were balloted for, and duly elected.

FREE LIFE-MEMBERS.

The following holders of the Society's diploma were elected free life-members, in terms of the By-laws:—

Alex. J. Farquharson, Estate Office, Blair Drummond, Perthshire; D. A. Gilchrist, Bothwell Park Farm, Bothwell; Robert Gordon, Gordonston, Clatt, Kennethmont; J. K. Ledingham, Slap, Turriff; T. H. Middleton, Rosefarm, Invergordon; Edward B. Purefoy, Greenfields, Tipperary; Norman Raeburn, 49 Manor Place, Edinburgh.

MELROSE SHOW, 1889.

Mr VILLIERS of Closeburn Hall stated that the general arrangements for the Show at Melrose on the 30th and 31st July and 1st and 2d August were progressing satisfactorily.

The following table shows the entries or head of stock, &c., which have been made for the forthcoming Show, with the entries at the last Show at Kelso in 1880, for comparison:—

	Melrose, 1889.	Kelso, 1880.
Cattle	269	275
Horses	236	226
Sheep	576	488
Swine	58	42
Poultry	222	244
Dairy produce	50	...
Implements	1262	1578

As post entries can be received up to Thursday, 20th June, there may be some additions to the above table.

A Committee has been appointed to make special arrangements with the Railway Companies, and when these are completed they will in due time be made public. In the meantime, he had to report that the North British Railway Company have arranged to make a siding into the Showyard at Melrose, and that the following extra charges will be made for traffic by passenger train booked through to the Showyard: Carriages, four wheels, 3s. 6d. per carriage; two wheels, 2s. 6d. per carriage; horse-boxes, 2s. 6d. per horse-box.

In accordance with the usual practice, the Commissioners of Supply for the counties embraced in the district of the Show—namely, Berwick, Roxburgh, Selkirk, and Peebles—appointed certain gentlemen to represent their respective counties in the

General Committee of Management. The following are the names of those nominated:—

County of Berwick.—John Allan of Peelwalls, Ayton; John Borthwick of Crookston, Heriot; Charles L. Stirling Cookson of Renton, Grantshouse; Captain Charles Hope of Cowdenknowes, Earlston; James Hunter of Antonshill, Coldstream; James S. Mack of Hillend, S.S.C., 1 Hanover Street, Edinburgh; George M'Dougal of Earlston Mains, Blythe, Lauder; James Nisbet of Lambden, Greenlaw; John Turnbull of Abbey St Bathans, W.S., 58 Frederick Street, Edinburgh; the Hon. The Master of Polwarth, Mertoun House, St Boswells; John Francis Pillans of Mains, Chirnside; John Wilson, Chapelhill, Cockburnspath; Hilton Middleton, Kimmerghame Mains, Duns; Adam Calder, West Blanerne, Chirnside; Robert Watson, Eccles Newton, Coldstream.

County of Peebles.—T. D. Carmichael, yr. of Skirling, Chiefswood, Melrose; W. C. Black of Kailzie, Peebles; M. G. Thorburn of Glenormiston, Innerleithen; Edward P. Tennant, yr. of The Glen, Innerleithen; W. A. Woddrop of Dalmarnock, Garvald House, Dolphinton; G. W. Muir, Kirkhouse, Innerleithen; G. D. Ritchie, Cloverhill, Biggar; Adam Brown, Drochil, Noblehouse; W. Ballantyne, Wormiston, Eddleston; George Forrest, Edston, Stobo.

County of Roxburgh.—The Hon. The Master of Polwarth; T. A. R. Carre of Cavers Carre, St Boswells; C. J. Cunningham of Muirhouselaw, Wooden, Kelso; John Freer, Melrose; John C. Scott of Synton, Hawick; Gideon Pott of Dod, Knowesouth, Jedburgh; John Brunton of Hiltonshill, St Boswells; John Paton of Crailing, Kelso; Lieut.-General Henry, C.B., The Pavilion, Melrose; W. E. O. Rutherford of Edgerton, Jedburgh; Robert Cunningham, Glendouglas, Jedburgh; John Caverhill, Jedneuk, Jedburgh; George Dove, St Boswells Bank, St Boswells; Thomas Usher, Courthill, Hawick; James Dodd, Hundalee Cottage, Jedburgh.

County of Selkirk.—T. Anderson of Ettrickshaws, Ettrick; Alex. Pringle of Whytbank, Yair, Selkirk; George Anderson of St Helens, Selkirk; R. J. Lang, yr. of Broadmeadows, Yarrow; Robert Haldane of Shaw, Cornhill, Coldstream; Robert Noble of Borthwickbrae, Hawick; John Murray of Glenmayne, Galashiels; Alex. Roberts of Manorhill, Selkirk; Archibald Stavert of Hoscote, Hawick; Right Hon. Lord Napier and Ettrick, K.T., Thirlestane Castle, Selkirk.

A large and influential deputation of Directors and other office-bearers, headed by Lord Polwarth, the President, will also attend during the Show.

A meeting of the General Committee was held at Melrose on the 13th instant, when the following sub-committees were appointed: *Admission to Parade Gallery.*—Mr Pott of Dod, convener; Mr Lang, yr. of Broadmeadows; Mr Freer, Melrose; General Henry, C.B., The Pavilion; Mr Riddell Carre of Cavers Carre; Mr Elliot, Blackhaugh; Mr Caverhill, Jedneuk; Mr Gibson Carmichael, yr. of Skirling. *Police.*—Lord Polwarth; Mr Turnbull of Abbey St Bathans; Mr Eliott Lockhart; The Master of Polwarth; Mr Scott Plummer of Sunderland Hall; Mr Lang, yr. of Broadmeadows. *Banquet.*—Lord Polwarth; Mr Elliot of Wolfelee; Mr Scott of Synton; Mr Freer, Melrose. *Ball.*—Mr Riddell Carre of Cavers Carre, convener; Mr James Curle, jun., Melrose; Mr Gibson Carmichael; Mr Cunningham of Muirhouselaw; Mr Leadbetter, Legerwood.

The following have been named to act as stewards: Mr Maxwell, yr. of Munches, for horses; Mr Elliot of Wolfelee, for cattle; Mr Howatson of Glenbuck, for sheep, swine, &c.; Mr Elliot, Hollybush, for forage; Mr Middleton, Clay of Allan, and Mr Kerr, Broomhouse, for implements. For the supply of refreshments in the Yard, the contracts have been given to John Mitchell and Aitchison & Sons, Edinburgh; D. M'Lagan, Galashiels; and Robert Wilson, Perth. The contract for the erection of the Showyard was in the hands of Mr James Farquhar, Broomhill Place, Aberdeen. The forage contracts have been given to Mr John Brown, Easter Housebyres, and Mr Mark Turnbull, Dingleton Mains. During the Show the headquarters of the Society will be at the George Hotel, Melrose. Tickets for admission to the Yard will be sent to all members residing in the United Kingdom whose addresses are known, and on no account will duplicates be issued. All members not producing their tickets must pay at the gate, and the admission money will not be returned. In aid of the general expenses of the Show, the following subscriptions have been received: Berwickshire, £215; Roxburghshire, £387, 19s. 11d.; Selkirkshire, £98, 13s. 9d.; Peeblesshire, £90, 4s. 9d. The Berwickshire Agricultural Association have intimated a contribution of 10 guineas. The following donations to the Premium Fund have been intimated—viz.: £105 by the Duke of Portland; £24 by Mr Macpherson Grant of Drumduan; £49 by breeders of half-bred sheep; £28 by Mr Howatson of Glenbuck; and a silver cup, of the value of £11, by the Earl of Southesk.

At the Board Meeting on the 5th instant, it was resolved to adopt the same regulations as were enforced at the Show last year—namely, "All owners of cattle entered for the Highland and Agricultural Society's Show at Melrose, from any district or county in which there has been any case of contagious disease within six months preceding the Show, must make declaration that such cattle have not been exposed at any fair or public mart within such county, nor have been in any way whatsoever exposed to contagious disease within a radius of two miles during the three months preceding the Show; and further, shall produce certificate from the clerk to the local authority of their district that within the last three months there has been no case of contagious disease within a radius of two miles from the locality in which such cattle have been kept,—said certificate to be handed to the steward at the Showyard cattle gate."

DUNDEE SHOW.

Mr **VILLIERS** said the Directors were rather surprised to hear from Dundee this morning that the subscriptions from Dundee and the neighbouring counties for next year's Show would amount to £1000. Now they had been led to believe that the subscription from Dundee alone would amount to £1000. They knew that Dundee, according to the newspapers, was now the most progressive and greatest city of the empire; and seeing that the Society had broken the rotation of their Shows, and perhaps got into trouble with the Fair Maid of Perth, they hoped that the people of Dundee would put their hands a little deeper in their pockets and subscribe £1000 themselves.

Mr **MACDUFF** of Bonhard explained that a Committee of the Society had been appointed to go to Dundee, and press on the authorities the necessity of increasing their grant, and he had no doubt, when the circumstances were fully explained, that the sum to be given would be further increased.

CHEMICAL DEPARTMENT.

Mr **M'QUEEN** of Crofts said: It will be in the recollection of members that a long discussion took place at the General Meeting in January last on the report submitted by the Directors. That report recommended: 1. That the Pumpherston Station be given up as soon as possible. 2. That the experimental clubs be continued and extended. 3. That the grant to analytical associations be continued. 4. That the half-fees for analyses to members be continued. 5. That Dr Aitken be allowed £450 for salary and laboratory expenses. After a long discussion it was, on the motion of Lieut.-Colonel Mackay, Carskey House, seconded by Mr Scott Dudgeon, resolved—"That the whole question of employment of the funds in promoting agricultural chemistry be delayed till next meeting for consideration and report by the Chemical Committee at the next General Meeting." Since the General Meeting the Chemical Committee have held two meetings—viz., on the 2d of April and on the 1st of May; and recommended for the consideration of the Directors: 1. That the experiments at Pumpherston Station be continued, at an outlay not exceeding £30 per annum. 2. That the grants to analytical associations be continued. 3. That the district club experiments be continued at a sum not exceeding £100, to be divided proportionally. 4. That the fees for analysis to members be continued as stated in the Premium-book. 5. That the Chemist of the Society be paid £400 per annum for salary, laboratory expenses, and other outlays, including rent of laboratory—making a probable expenditure in all of £610. The Board of Directors at their meetings on the 1st of May and 5th of June agreed to the report of the Chemical Committee, and I have now the honour to submit it for the approval of this meeting.

Mr **COWE**, Balhousie, read a circular issued by Dr Aitken, urging the recipient to come up to the meeting and prevent injury from being done to the Chemical Department by "an unscrupulous faction, and those who were deceived by their pernicious misrepresentations." That was as much as to say that he and those who thought with him on this subject were an unscrupulous lot, who were trying to deceive the Society by pernicious misrepresentations; and he gave them all due notice that they would hear further from him on this subject at the Melrose meeting.

Mr **PATERSON** of Birthwood said it was a pity that a genial and highly esteemed gentleman like Mr Cowe should trouble himself about such matters.

Mr **SCOTT DUDGEON** complained of the want of details respecting the work of the Chemical Department. He thought there should have been an intelligent report submitted to let the Society know what they were doing.

Mr **MELVIN**, Bonnington, addressed the meeting at considerable length, but the audience became impatient, and he sat down.

The **CHAIRMAN** deprecated the issuing of circulars in any form in regard to matters which came before them.

Dr **AITKEN** having explained the circumstances under which he had issued the circular, the matter was allowed to drop.

REPORT OF CHEMIST.

Dr A. P. **AITKEN** said:—

It is unnecessary that I should occupy the time of the meeting with any detailed reference to the work of the Chemical Department, seeing that it has been fully described in the volume of the 'Transactions' just published.

The experiments undertaken by clubs and associations throughout the country, and described in that report, are being repeated in most places; and a further set of experiments is in progress on about sixty farms to try the relative advantages of winter and spring manuring of turnips.

Since last General Meeting, I have visited seven districts where experiments are going on, and have been gratified to find how much interest and enthusiasm these experiments are creating, and how thoroughly the work is being done. Printed schedules carefully describing the details of each experiment are issued to those interested, and the whole is under the superintendence of local Committees. My visits to the various districts were taken advantage of by farmers for discussing not only the experiments, but other subjects affecting the agriculture of the district, and means were taken to give practical effect to proposed improvements. I regard these local investigations as the natural and proper development of the work which we have been carrying on at the stations; for as soils and climates differ, the results due to the application of manures differ in various ways, and while there are many truths of general application that have been taught on the stations of the Society and others, there are many questions that are local in their character and scope, true answers to which can be had by means of local investigation alone.

It is to the formation of local Societies properly organised and educated in the methods of investigation that we must look for a wider dissemination of agricultural knowledge and a much more rapid attainment of reliable results than have been possible hitherto. It is frequently a difficult or even an impossible thing to distinguish results which are of only local or accidental significance from those which are of general and necessary application when one is restricted to one set of circumstances in his investigations, but by means of a number of workers co-operating in various parts of the country, and practically trained to the work, results are able to be obtained and truths made manifest in one season which it would otherwise take many years to elucidate.

The grass experiments at the Pumpherston Experimental Station are now well worthy of a visit by those who are well acquainted with grasses and interested in the manuring of grass land, and also by those who are interested in the subject of unexhausted fertility due to the former application of light manures. For this purpose a public demonstration will shortly be held after due advertisement.

Botanical Report.

Mr A. N. M'Alpine said: I have the honour to report that during the past season I have examined over 280 samples of grass and clover seeds. The germination is, as a rule, above the average, and the purity is, on the whole, very satisfactory. Among the clovers the percentage of hard seeds was much less than usual, and the percentage rotten rarely exceeded 4 per cent. The following figures show the purity and germination of the seeds tested:—

		Germination. Per cent.	Purity. Per cent.
Fescues	Meadow	95·100	98·100
	Tall	90·98	98·100
	Sheep's Hard	82·89	96·98
Cocksfoot		72·96	94·100
Foxtail		52·72	94·99
Dogstail		82·92	98·100
Ryegrasses	Italian	75·96	95·100
	Perennial	75·98	95·99
Timothy		78·97	97·100
Clovers	Red	89·98	96·100
	Cow grass	87·98	96·100
	Alsike	85·96	95·100
	White	78·98	97·100
Trefoil		·99	99·100

Experiments on Grasses.

Dr Cleghorn gave in a preliminary report with regard to experiments on grasses.

Forestry Department.

Sir Robert Menzies of Menzies, Bart., reported that the suggestion made at the General Meeting in January last, to communicate with various bodies named by the Select Committee of the House of Commons, with reference to the formation of a

Board of Forestry, had been carried out. The Society received courteous replies from the whole of the bodies addressed. Some did not at present propose to take any action in the matter; others, the English and Scottish Arboricultural Societies, have forwarded petitions pointing out the necessity of Government giving effect to the recommendations of the Select Committee. But it is now understood that Government will defer dealing with the question till the Department of Agriculture has been properly constituted.

AGRICULTURAL EDUCATION.

The Rev. JOHN GILLESPIE, Mouswald, reported that the annual examination of candidates for the Society's diploma and certificate in Agriculture was held on the 27th, 28th, and 29th March. The number of candidates who presented themselves was fifteen. The examination resulted in seven passing for the diploma, and four for the first-class certificate, viz.:—

For diploma—Alexander John Farquharson, Estate Office, Blair Drummond, Perthshire; Douglas Alston Gilchrist, Bothwell Park Farm, Bothwell; Robert Gordon, Gordonston, Clatt, Kennethmont; John Knox Ledingham, Slap, Turriff; Thomas Hudson Middleton, Rosefarm, Invergordon; Norman Raeburn, 49 Manor Place, Edinburgh; Edward Bagwell Purefoy, Greenfields, Tipperary. *For first-class certificate*—Thomas Askew Coward, Eden Town, Carlisle; James Kerr, Mid Kelton, Castle-Douglas; Ash Rudd, M.R.A.C., East Ruston Hall, Stalham, Norwich; Archibald William Woodburn, 6 Sardinia Terrace, Hillhead, Glasgow.

Mr GILLESPIE also announced that the prizes given in books to the class of Agriculture in the University of Edinburgh had this year been awarded as follows: £6 to John Bayne, Millhill, Braco, Perthshire; and £4 to Thomas Askew Coward, Carlisle.

PROPOSED BOARD OF AGRICULTURE.

The Rev. JOHN GILLESPIE reported that on the 28th of March a deputation—consisting of Sir Robert Menzies; Mr Stirling of Kippendavie; Mr Maxwell, yr. of Munches; Mr F. N. Menzies, Secretary; and himself—had waited on Lord Cranbrook, and stated that although they cordially approved of the proposal to create a Board of Agriculture, they thought that practical agriculturists should be invited either to join it or to form an Auxiliary Committee in connection with it. Lord Cranbrook promised to report to his colleagues the point in the Bill to which attention had been called. He suggested that the Scotch members should be asked to urge on the Government the advisability of appointing an Auxiliary Committee, made up of representative agriculturists from different parts of the kingdom, to act under the Bill with the Minister that would be appointed.

TRANSACTIONS.

Rev. JOHN GILLESPIE said: I have to report that Mr Irvine of Drum has resigned the chairmanship of the Committee on Publications, and that the Board have appointed me to discharge the duties of that office. Few officers have evinced so much zeal in the exercise of their official duties as Mr Irvine; and the Directors at their first meeting after the resignation was received, adopted the following resolution, which, I am sure, will be cordially received by you: "That Mr Irvine of Drum having presided over the Committee on Publications for a period of thirty-five years, the Directors deem it due to him that the minutes of the Society should bear a permanent record of the sense which they entertain of his unremitting and valuable services. The Directors therefore resolve that the cordial thanks of the Society be given to Mr Irvine for the important services rendered by him as a Member, a Director, and as Chairman of the Committee on Publications." I have now to submit the volume of the 'Transactions' for the present year. It is the first of a new series—the fifth—and contains eighteen articles on different subjects, besides a variety of reports in connection with the Chemical Department, and the usual official documents. The Committee on Publications last year directed that a general index should be prepared to the last or fourth series, from 1866 to 1888, both inclusive. The instructions of the Committee have been carried out, and I have now to submit it also. The index is arranged in two parts. The first gives the authors' names alphabetically, followed by the subjects and places treated.

Mr GILLESPIE paid a high tribute to Mr Duncan, one of the officials of the Society, for the energy and painstaking care which had been displayed by him in the compilation of the index to the 'Transactions' which was recently issued.

PLEURO-PNEUMONIA.

Mr MAXWELL, yr. of Munches, gave in the report of the Society's deputation to the Privy Council on the subject of pleuro-pneumonia. They had urged on the

Lord President that the owners of animals slaughtered from being affected with pleuro-pneumonia should be paid compensation out of the Imperial funds. The Government, Mr Maxwell stated, had not seen their way to give effect to the representation.

IRISH CHANNEL TRAFFIC.

Mr MAXWELL, yr. of Munches, stated that, with Sir Robert Menzies, Mr Stirling, Mr Gillespie, and the Secretary, he had attended a Conference in London on 28th March with the Royal Society of England and the Royal Dublin Society, and that after considerable discussion resolutions were adopted by the Conference to secure better arrangements for loading cattle at railway stations in Ireland, and also at the wharves, better accommodation on board ship, better ventilation and efficient supervision, and the necessity of more stringently enforcing existing regulations. On the following day these resolutions were laid before the Lord President of the Council. Mr Naper stated the case for the Irish Society, Mr Stirling for the Highland Society, and Mr Jacob Wilson for the Royal Society of England. The President expressed regret at the unavoidable absence of his colleagues, the Secretaries for Scotland and Ireland, and after replying to some of the arguments that had been raised, said that the question was one of great importance, and promised to give the representations careful consideration.

Attention was directed to the fact that the anomalies of the traffic had been in no way abated, and urged that the matter should be further pressed on the attention of the Government. On the suggestion of the CHAIRMAN, the matter was remitted to the Committee to consider the whole question of the transit of cattle by water.

Sir ALEX. MUIR MACKENZIE urged upon the Society not to let the matter rest. It was getting too serious; and he asked that Mr Maxwell and the deputation should go again to London, and not come back till they got the assurance that the Privy Council would do more than take the matter into their serious consideration.

Mr PATERSON of Birthwood proposed that the Society should have a direct motion on the subject.

The Rev. JOHN GILLESPIE, as one of the deputation, said that the state of matters with regard to the transit of cattle from Ireland was a disgrace to civilisation, and not only was there need of fresh regulations, but the regulations at present in force were being ignored by the officials of the Government.

The CHAIRMAN said the hardships endured by cattle in crossing from Ireland to this country were very great, but the grievance, he showed, was general. Cattle coming from various parts of England were brought up at various times of the year under such conditions that it was a marvel to himself that they kept their health. He thought, however, it would be a pity if they were to take any hasty action, and he suggested that the matter should be more fully considered.

ORDNANCE SURVEY.

The SECRETARY (Mr Menzies) said: The completion of the Ordnance survey of Scotland has long engaged the Society's attention, and the steps taken by the Directors in urging on Government the prosecution of the survey will be found recorded in the 'Transactions.' At the General Meeting in January last, a memorial to the Director-General of Survey was adopted, setting forth that the Society was greatly disappointed to learn that it was intended to postpone the commencement of the 1.2500th scale maps till after the completion of the maps of Yorkshire and Lancashire, and praying that the survey of Scotland should be resumed simultaneously with that of England. In reply to this memorial, a letter was received from H.M. Office of Works, London, dated 27th Feb., pointing out that, although it would be possible to transfer to Scotland one of the Survey divisions now in Yorkshire, such transfer would not materially expedite the completion of the map of Scotland, and it would inconveniently interfere with the present arrangements to make any change in the existing condition. To this communication the Directors replied, protesting against the delay, and strongly, but respectfully, urged that a division of the Survey staff be sent to Scotland, and that the resumption of the 1.2500th plans be undertaken without delay.

A second letter from the Office of Works, London, dated 14th April, was received, repeating that it would not be advisable to detach a division of the Survey from England, and giving an assurance that so soon as the resurvey of Yorkshire and Lancashire shall have been completed, three divisions of the Survey will be stationed in Scotland, and maintained there continuously until the survey is completed; also stating that they had opened a Survey Office in Edinburgh. At the meeting of the Directors on 1st May last, the Secretary was instructed to express regret at the course adopted, and to express a hope that the First Commissioner of her Majesty's Works might see his way to commence the survey of Scotland.

The **Secretary** then read the following letter from Mr Dundas of Arniston:—

"London, 17*th June* 1889.

"My dear Menzies,—I see by the note of business for 19th June that the Highland and Agricultural Society are to memorialise the Director of the Ordnance Survey upon the continued delay of the 1.2500th survey of Scotland.

"Be so good as to inform the Directors that, as convener of Mid-Lothian, one of the six counties interested in the resumption of the survey, I am doing what I can in the same direction here.

"The Directors are aware that some years ago, when the work of the 1.2500th survey was resumed in the north of England, and ought to have been in Scotland, the then Director of the Survey, for the sake of keeping his force together, sent all his available men into the north of England, and left the Scotch work at a standstill.

"The work in the north of England is now so near completion that no very great advantage would be got by diverting a small portion of the force to Scotland. But while acquiescing in that view, urged by the Director, we must urge, and have it clearly understood, that when once Scotland is reached, *the whole force now employed in the north of England shall be moved across the Border and kept there until the* 1.2500*th survey has been completed.* It has been suggested that when Scotland is reached, three or four divisions of surveyors out of the eight now in the north of England might be sufficient. But that would never do. To cut down the force to one-half would simply mean further delay in the completion of the survey. Our reasonable request should be—Treat the six Scotch counties just as you have treated the six northern counties of England.—Believe me, yours truly, Robert Dundas.

"F. N. Menzies, Esq.,
Highland and Agricultural Society,
3 George IV. Bridge, Edinburgh."

Margarine Cheese.

The Rev. **John Gillespie** reported that on the 28th March the same deputation had waited on the President of the Board of Trade, and represented the views of the Society that margarine cheese should be put on the same footing in the eyes of the law as margarine butter. He stated that a deputation from the Home and Foreign Produce Exchange had appeared at the same time, and not only expressed the same views in regard to margarine cheese, but pointed out that the provisions of the Act were not sufficiently carried out with reference to margarine butter. The President stated that the Government would not be able, in the present condition of business, to introduce a Bill this year, but it was suggested that the deputation should try to get their views carried out by a private Bill brought before the House of Commons.

Railway Rates.

The Rev. **John Gillespie** gave in the report on this subject, which was adopted.

Truck Amendment Bill.

The **Secretary** (Mr Menzies) reported that the following petition had been presented to the House of Commons in reference to Mr Haldane's Truck Amendment Bill, and that copies had been sent to all the Scotch members—viz.: "That your petitioners, as representing the proprietors and occupiers of land in Scotland, are deeply interested in the prosperity of the agricultural classes, and are strongly opposed to the Bill, brought into your honourable House by Mr Haldane, to apply the Truck Act in the payment of farm-servants. That your petitioners view with alarm this attempt to interfere with the arrangements which at present exist between the agriculturist and the servant, under which, as a general rule, the farm-servant is much better off than he would be if paid entirely in cash. That your petitioners are of opinion that the present system of paying farm-servants, partly by money and partly in kind, is in no way analogous to the system aimed at and destroyed by the Truck Act. That they beg that, before the Bill is considered, inquiry be made into the working of the present system, as your petitioners consider it a Bill calculated to injure the farm-servant and put a stop to many privileges he now enjoys. That your petitioners consider the Bill uncalled-for and pernicious, and if passed into law likely to injure the farm-servant instead of being a benefit to him. Your petitioners therefore pray your honourable House that said Bill may not pass into law."

A vote of thanks to the Chairman, on the motion of Mr **Villiers**, closed the proceedings.

GENERAL MEETING IN THE SHOWYARD AT MELROSE,
31ST JULY 1889.

The usual General Meeting of members of the Society was held in the Pavilion of the Showyard at half-past eleven o'clock. In anticipation of an animated discussion over the Chemical Department—regarding which a notice of motion had been given by Mr Cowe, Balhousie—there was a crowded attendance.

Lord **POLWARTH** (who presided) announced, in opening the proceedings, that his uncle, Admiral Baillie, had died during the previous night, and he expressed the hope that the business of the meeting would be transacted with that calm dignity and good feeling which was best calculated to promote the business of the Society. All present would, he thought, agree that a meeting held in the Showyard, amidst such a variety of attractions, when they were anxious to get outside, should not be prolonged, and he hoped that the gentlemen who spoke would be as brief as possible.

The first business consisted of the customary votes of thanks to those who had contributed to the success of the Show. On the motion of Colonel **STIRLING** of Kippendavie, seconded by Mr **MACKENZIE** of Dalmore, a vote of thanks was awarded to the Right Hon. Lord Polwarth, President of the Society, for the zeal which he had at all times displayed in promoting its interests. A similar vote was, on the motion of Mr **GILMOUR** of Montrave, seconded by Mr **M'QUEEN** of Crofts, passed to the Commissioners of Supply of Berwick, Roxburgh, Selkirk, and Peebles, and the other subscribers; and a like compliment was paid to the Local Committee for their energy, and for the excellent site which they had provided.

The **CHAIRMAN**, in returning thanks, said the agricultural interests of this country were second to none; indeed, he thought they were almost more important than any other interest, commercial or political. He was deeply sensible that he had been able to do little, indeed, for the Highland Society; but he strongly desired to do everything in his power to further the interests of peace and harmonious working. No society could prosper that was at warfare within itself. They wished to have all the agriculturists in Scotland engaged in furthering the best interests of the Society. It was the oldest Society of the kind in the country, and his desire was that as it grew older it would flourish more and more, for it had yet a greater work to do than it had done in the past. His Lordship concluded by mentioning that, along with some of the other Directors of the Society, he had been invited to the Windsor Show, and on his motion it was unanimously agreed. to instruct the Secretary to thank the Royal Society for their courtesy and kindness during their visit.

It was also agreed to congratulate Sir Jacob Wilson, the honorary Director of the Royal Agricultural Society, on the honour which he has recently received at the hands of her Majesty.

CONTAGIOUS DISEASES AMONG FARM STOCK.

Mr **COWE**, Balhousie, in terms of notice previously given, moved as follows: "That the Directors instruct their veterinary adviser to conduct investigations into the diseases which are seriously affecting farm live stock, and within such limits as they think necessary; and fix such a salary per annum as they may consider adequate." Speaking to the motion, Mr Cowe said some time ago a Committee had been appointed to consider the question of pleuro-pneumonia. That Committee had considered the matter fully, and had given them a capital report, although, unfortunately, they afterwards had not acted upon it. His present object was to draw attention to the fact that the Highland Society had taken upon itself the responsibility of urging on the Privy Council the indiscriminate slaughter of all animals suffering from pleuro-pneumonia.

Mr **DICKIE**, Kileonan, Campbeltown, seconded Mr Cowe's motion, on the ground that it was a step in the right direction.

Sir **JAMES GIBSON-CRAIG**, Convener of the Veterinary Committee, made a statement in regard to the matter. He said they were perfectly ready to accept the motion, with this qualifying remark, that they hoped no one present would think that the Committee had hitherto neglected such an important part of their duty. A few years ago an investigation into "louping-ill" in sheep had been carried out, and a considerable amount of good had resulted from it. Two years ago another investigation had taken place into the cause of abortion in cows, which was at that time prevalent in the north and north-east of Scotland. The matter of pleuro-pneumonia was a very difficult one to deal with, and one which, he thought, they had better not go into on that occasion. He only wished to say as to it, that a couple of years ago, when he retired from the Board, he had written a letter to the Board strongly urging on them the necessity of setting on foot such an investigation as was proposed, and of making it as extensive as possible, and at the same time offering to subscribe towards the expenses. He hoped very much they might get this done. They were perfectly ready to accept the motion—which described just what they had been doing—with one slight alteration. The last clause in the motion read, "And fix such a salary as they may consider adequate." His suggestion was that this should be altered to, "And grant such remuneration as they may consider adequate." The simple reason was that they could not give to a veterinary adviser a large salary every year, because his work was sometimes more and sometimes less.

Mr **Arklay** of Ethiebeaton, Forfarshire, said he thought Mr Cowe's motion was one which should not be dismissed summarily. With regard to inoculation, he thought it was in its infancy in many parts of the country. He had himself no experience of inoculation so far as pleuro-pneumonia in his stock was concerned; but when the rinderpest was in the country, he had then great faith in inoculation, and he kept his stock free from that disease by having them inoculated. Mr Arklay was explaining how this inoculation was carried out, when

The **Chairman** interposed with the remark that he feared Mr Arklay was departing from the subject under discussion. He quite acknowledged the importance of the subject, but he did not think it was exactly before the meeting.

Professor **Williams**, Edinburgh, said the question of money between himself and the Society had never had any existence in his mind during the twenty-two years of their connection. While he had nothing to do with Mr Cowe or the motion which he had proposed, he accepted the alteration, provided his position in the Society was properly defined, for he did object to his duties being usurped by the Chemist, as had been done in the past.

The Rev. **John Gillespie**, Mouswald, said Professor Williams was entering upon a matter which would lead to a long discussion. As a member of the Board, he was quite willing to explain why Professor Williams did not happen to be engaged on a recent occasion, but he deprecated the matter being gone into on that occasion.

The **Chairman** said he did not think it necessary to pursue the matter further. Professor Williams would have his status properly defined by the Society.

Effect having been given to Sir James Gibson-Craig's suggestion, the motion was adopted.

The Experimental Stations.

Mr **Cowe** then said that the second motion he had to move was as follows: "(1) That Pumpherston Station be given up, or, if retained, be supervised by practical agriculturists. (2) That the salary of the Chemist be fixed at £200 per annum." If the servants of the Society, he said, were to describe members as an unscrupulous faction, and their recommendations as pernicious, he for one, so long as he was a member, would come forward year after year and give them no peace. He would continue to protest if independent members were treated and described in such a manner by a paid servant, be he who he might. In support of the motion, he would only state to the meeting a few simple facts in regard to the stations, and leave them to draw their own conclusions. Since the stations were started, they had paid in salaries —that was to the Chemist, he meant—£5677, and for the experimental stations £2692, making in all over £8369. And what had they got for that? He was a farmer himself, and he had to pay rent; and if their Chemist could not teach them to grow better crops, chemistry was of little consequence to them. But what had these results been? From what they had sold off their station they had realised £1261, and they had left £7354, 17s. as the amount they had paid for the knowledge that had been imparted from these stations. He challenged practical agriculturists, who had, like himself, rents to pay, to say what practical knowledge they had ever received from those experimental stations? He was one of those simple-minded men who believed that if a man were to give an honest article he must be paid an honest price for it; and he went further, and declared that at the present moment they were drowned with literature so far as chemistry was concerned. That was his first argument. As to the matter of the salary which he would propose should be paid to their Chemist, he suggested that the sum should be fixed at £200 per annum. In doing so, he did not despise the qualifications of Dr Aitken—indeed he had not one word to say against him. What he said was this, that the Society was putting Dr Aitken in a false position under the present arrangement; for they had experimental stations in operation, while at the same time their Chemist was located in Edinburgh, and was not therefore able to look after the practical work at those stations. He, for one, did not grudge Dr Aitken £200; but he said that if they were to subsidise a chemist for £200 a-year, and at the same time invited members from every part of the country to send to him for analysis, they were giving that official far too much work to do. This he (Mr Cowe) insisted upon, that those who assisted the Chemist in his work should be under his direct supervision, as he (the speaker) had reason to believe that inaccuracies in the matter of analysis had occurred owing to the want of proper supervision.

Mr **Arklay** seconded the motion.

Mr **Mackenzie** of Portmore, who moved a direct negative, thought that Mr Cowe's motion was one which ought not to have been brought up at this meeting. It was a contentious subject, which had been before the Society year after year; and it was much better that such matters should be discussed in Edinburgh rather than at the present time. The meeting was aware that this matter had been before the last two General Meetings of the Society, and had been settled as late as June last. He thought it was extremely injudicious to bring the subject up again within sixty days of its having been adjudicated upon by the Society in general meeting. He did not propose to go into the figures given by Mr Cowe. The whole matter of those statements had been in the hands of the Society every year in the published reports; and if any one had taken the trouble to read those reports, he was able to judge for himself whether the Society had obtained value for its money or not. (A voice—"Little value.") That might be the opinion of the gentleman who had spoken, but it was not his (Mr Mackenzie's).

The **Chairman**—I shall call to order any gentleman who presumes to interrupt a speaker.

Mr **Mackenzie** (continuing) remarked that if the proposition regarding the salary were carried it would be a good bargain for the Chemist. At present Dr Aitken was paid £400, out of which he had to provide his own assistants, and to pay the other expenses in connection with his office. If they gave him £200, he (Mr Mackenzie) believed that they would be giving him more than he received absolutely at this moment. He would remind them that whatever resolution they came to to-day, it could not affect the status of Dr Aitken until two General Meetings had been held. Dr Aitken was under contract for a year, and what was the use of passing an abstract resolution like this with all that time before them? He hoped that this meeting would put the matter at rest for the present by declining to entertain the motion.

The **Chairman** said that it appeared to him that Mr Mackenzie's suggestion was one worthy of consideration. He was sure the Directors had no wish to shirk this question. On the contrary, they wished to give it their fullest consideration. They had heard that no alteration could be made in the contract between the Society and Dr Aitken at the present time; and he thought they might rest satisfied that this subject would not be lost sight of by their Directors. At any rate, they had the cure in their own hands, because the Directors came from all parts of the country, and they had only to take care that their particular Director did not lose sight of it himself.

Mr **Cowe** said he had willingly accepted the last amendment; but if he pressed this motion it must be on the distinct understanding that any engagements entered into by the Directors of the Society must be implemented to the full, because it would be unfair to Dr Aitken, after having engaged him for two years, if any other course were taken, and it was well for the Doctor to have time to ponder over the matter. He was quite prepared to submit his resolution to the meeting.

Mr **M'Queen** of Crofts seconded the amendment. He observed that, as the Vice-Convener of the Chemical Committee, he had had a good deal to do with the recent alterations and changes. It was a good many years since Mr Cowe and others stirred in this matter, and the Directors, in view of the economy that was desired, had had a good many meetings in connection with the subject,—at any rate the Chemical Committee had,—and they decided on doing certain things. That course was approved by the last General Meeting, and the Directors, elected now by popular election, were quite unanimous in regard to the matter. He thought it would be a great pity, after doing that, if the meeting to-day should overturn what had been decided upon unanimously by the Directors. They had made a considerable reduction on the expenses of the Chemical Committee, having reduced the expenditure from £600 to £400. Besides, they had discontinued the Harelaw Station, and had continued the Pumpherston Station because Mr M'Lagan wished it continued and would charge no rent for it. He thought it was necessary that the Highland Society should have a Chemical Department, and they could not carry it on efficiently unless the members agreed to what the Directors had done.

A show of hands was then taken, when 123 supported the amendment and 101 the motion.

The Exclusion of Aberdeen Cattle.

The **Chairman** said they had no other business on the programme, but he believed some gentlemen present wished to refer to a matter which concerned them considerably; and although it might not be exactly in conformity with the Society's regulations that the subject should be taken up, he was quite sure that the Directorate and the meeting generally had no wish whatever to prevent its being referred to on the present occasion. Before anything was said, he might say,—trusting it would help to calm any feeling which might have arisen in some quarters,—that it seemed to him—and he had a very intimate knowledge of the ins and outs of the matter—that there had been some unfortunate mistake. At the same time, he was quite sure that nothing could have been further from the wishes and desires of any gentleman connected with the Society than to exclude or hinder gentlemen from exhibiting their animals at that Show. On the contrary, they felt that every animal kept away was a very grievous loss.

Mr **Gordon** of Newton, Insch, Aberdeenshire, prefaced his remarks by saying that he made them in the spirit in which his Lordship had spoken, and only in the hope of removing, by amicable explanation, a very considerable amount of indignation and adverse feeling which undoubtedly existed in the north-eastern counties at the manner in which their showyard cattle had been excluded from the Melrose yard. In the county of Aberdeen they had made strong efforts to eradicate pleuro-pneumonia. They had laboured hard, had slaughtered valuable cattle, and had spent money in order to reduce the ravages of the disease in the district; and he was sure from the experience they had of the strictness of the rules of the Aberdeen Local Authority, that had the intimation in question been sent to them some weeks ago so as not to so seriously disarrange their various arrangements for showing cattle at Aberdeen and at Melrose, there would have been no grumbling on the part of the exhibitors at the Royal Northern Show. But they had been led to believe in the same way as last year that cattle would be admitted to the Highland Society's Show if exhibited at the Royal Northern Show; and it had only been on Monday of last week—within three days of the Royal Northern Show, when many of the cattle from the higher districts had already started towards Aberdeen—that they received any intimation that their cattle would be excluded from Melrose. On the receipt of that communication by Mr Lumsden, the County Clerk, who was also the clerk to the Local Authority of Aberdeenshire, that gentleman wired to Mr Menzies, and he wished to draw particular attention to this point, not that he wished to make any reflection on Mr Menzies, but because it seemed to him that if they had only known where the obstacle or bar was which prevented them having admission to the Melrose Show, they might possibly have been successful in removing it. No answer was received in Aberdeen to Mr Lumsden's telegram until late on Wednesday night—the only acknowledgment received during the day being one to the effect that Mr Menzies was from home, and would not be back till the following day. That, of course, was very inconvenient, and still, having no knowledge of what the obstacle was, they were fully justified in believing that the same course would be followed this year as last. On the Wednesday it had transpired that the obstacle rested with the Local Authority of Roxburghshire, who, on the following day, he believed, held a meeting and interpreted their rules so as to exclude the Royal Northern cattle from the county. On learning this, they resolved to despatch their county clerk and inspector from Aberdeen to explain to the officials in Roxburgh the real state of matters—viz., that they had had no fresh outbreak of pleuro in the county of Aberdeen since the 13th June last, that then and there several beasts which had been in contact with the infected animals had been slaughtered, and that a half-mile cordon had been drawn round the affected area, the Aberdeen showyard being 800 yards outside the line. In the circumstances they could not but feel themselves a little aggrieved that a little more expedition had not been shown on the part of the officials of the Society and of the Roxburgh county authorities in the way of explaining the circumstances under which entry to the Show was denied them. His sole object in saying what he had was to endeavour to remove the serious discontent which existed at the way the Royal Northern exhibitors had been treated, and to promote that cordial spirit of amity to which the Chairman had alluded.

Sir **James Gibson-Craig** made an explanation regarding the subject brought up by Mr Gordon. On behalf of the whole Board, he said, he must acknowledge the extreme moderation and the courtesy with which Mr Gordon had stated his case. He must also express the Directors' extreme regret that there was any misunderstanding or disappointment to their friends in Aberdeenshire. It was certainly not for the Directors to prevent animals coming to the Show after being at the expense of erecting shedding and providing everything for their accommodation. The first communication they received was a letter from Mr Bruce, the secretary of the Royal Northern Agricultural Society, to Mr Menzies, on the 8th July. Mr Bruce wrote: "There has been one case of pleuro within about a couple of miles of our showyard, but my committee do not think such of any moment, or likely to affect our show in any way; indeed our entries are just about the same as last year's. I think you may therefore safely advise your Showyard Committee to allow any cattle exhibited here to be shown at Melrose." That was received on the 9th July, and that same day Mr Menzies wrote: "The exhibitors must make a declaration, and you and I have nothing to do with the matter. My Directors held last year that a show was not a mart or fair, and the cattle from the Royal Northern were all admitted to our Show, and I have no doubt will be again. We are going on exactly the same groove we did last year." Of course this letter was written on the supposition that Mr Bruce's statement was a correct statement of facts—that the case of pleuro was two miles off. And perhaps, at this stage, he might refresh their memories as to what the regulations were. They were to the effect—"Any one exhibiting must make a declaration that such cattle have not been exposed at any fair or public mart within such county, nor have been in any way whatever exposed to contagious disease within a radius of two miles during the three months preceding the show." They heard nothing more about the matter. The two miles were mentioned, and it was not thought necessary to have a special meeting of the Board to consider the matter as they had at Perth. Then the next communication they had on the subject was from the clerk of the Local Authority of Aberdeenshire, who wrote on the 20th to Mr Menzies: "With reference to your Directors' regulation, I have to point out that the show of the Royal Northern Agricultural Society falls to be held at Kittybrewster on Thursday, 25th inst. On the 13th ult. an outbreak of pleuro-pneumonia occurred within the police burgh of Woodside, and in consequence, the burgh and the adjoining district has been declared, by an Order of the Privy Council, an infected area. This area is within two miles of Kittybrewster, where the local show is held." That was received on Monday the 22d. Mr Menzies immediately wired the terms of these regulations: "Cattle that have been within two miles cannot come to Melrose. See circular. Let exhibitors at Royal Northern know." On the same day Mr Lumsden wired in reply: "No pleuro now known within Aberdeenshire. Diseased cattle and cattle in contact all slaughtered. Letter follows." To this Mr Menzies replied on the same day: "If Roxburgh Local Authority removes objections, I will admit cattle."

Mr GORDON (interposing)—We did not receive any telegram to that effect in Aberdeen on Monday.

Sir JAMES GIBSON-CRAIG—We have it entered in the book as having been sent.

Mr GORDON—We had no reply, except that Mr Menzies was from home.

Sir JAMES GIBSON-CRAIG—I am coming to that. Allow me to complete my statement. Continuing, he said that on the 23d Mr Lumsden wired—"Pray obtain reconsideration by Highland Directors of decision to exclude Aberdeen cattle at Melrose. There are no fresh outbreaks of pleuro, and when all arrangements made in accordance with circular, it is very hard on exhibitors, and great loss to them, to stop cattle at last hour. My strong opinion is that no danger exists of infection at these shows." There seemed to have been some misunderstanding about all this wiring. That day Mr Menzies was attending to his duties at Melrose, and Mr Duncan was unable to communicate with him. Next morning, and in order to give all consideration to the matter, Mr Menzies wired (on the 24th)—"Wire exact distance showyard is from infected area." Thereupon Mr Lumsden wired—"Showyard gate 800 yards from boundary of area. I repeat, no pleuro in county or burgh, and no animal can come out of area without licence." All Mr Menzies could do then was to report this to the Local Authority of Roxburgh, which he did by telegram, and he informed Mr Lumsden on the same day that he had wired the Roxburgh Local Authority. The Roxburgh Local Authority, at a meeting the next day, which was summoned by telegraph, decided that they could not admit the cattle within the county, and, that being the case, it was obvious the Directors could not, of course, admit the cattle within the showyard. He hoped they would do all they could to allay any misunderstanding; but he wanted to impress upon them the absolute necessity of extreme caution in holding this great Show. Their very existence depended upon them, and if they erred on any side at all, it must be on the side of care. They must remember that it was not only the getting of cattle to the Show, but also the getting of them away. If there was any "sough" about infected cattle being sent to the Show, not a single county would allow them back again. They must also remember that if there was the slightest suspicion about taking most extreme precautions to prevent the chances of misfortune, none of them would run the risk of sending their cattle to the Show. He could only repeat that they deeply regretted what had taken place; and if there had been any misunderstanding, or hardship, or soreness, they felt it as much as any one, and if any man felt it more deeply than another, that man was their noble chairman, Lord Polwarth. He hoped this explanation would be considered satisfactory.

The CHAIRMAN said he thought that this was not a question for motions, but simply for explanations between the two Societies. He trusted that the explanation which had been given would be satisfactory, and that they should have no need to pursue this matter any further. There had evidently been mistakes, which had led to misunderstanding. They regretted that these had taken place, and they sincerely trusted that their Aberdeenshire friends would feel that they very deeply regretted anything that had taken place. He trusted that this matter might now be allowed to drop.

Mr DUTHIE of Collynie, as an exhibitor from Aberdeenshire, remarked that he did not believe there was one member of the Royal Northern Society, or any exhibitor at the Show, who thought that there was any intention at all on the part of the management of the Highland Society to exclude their cattle. They in Aberdeenshire did feel that some one had blundered, and who that blunderer was would no doubt be clear to most of them.

On the motion of Mr **Stirling** of Kippendavie, a vote of thanks was passed to the chairman, and the proceedings then ended.

ANNIVERSARY GENERAL MEETING, 22D JANUARY 1890.

The **Earl of Haddington**, Vice-President, occupied the chair, in the absence of the President, Lord Polwarth, who was prevented by indisposition from being present.

Admission of New Members.

Mr F. N. **Menzies**, Secretary, read a list of 66 names of gentlemen who were balloted for and admitted as members.

Election of Office-bearers.

The following noblemen and gentlemen were proposed office-bearers of the Society, viz.: *President*—The Earl of Strathmore. *Vice-Presidents*—The Earl of Airlie; Colonel Anstruther Thomson of Charlton; James M'Queen of Crofts; Jonathan Middleton, Clay of Allan. *Ordinary Directors*—Walter Elliot, Hollybush; J. T. S. Elliot of Wolfelee; Thomas D. Findlay of Easterhill; John Gilmour of Montrave; Donald Fisher, Jellyholm; R. G. Wardlaw Ramsay of Whitehill; George Wilken, Waterside of Forbes; James Lockhart, Mains of Airies; John Cran, Kirkton; The Hon. the Master of Polwarth. *Extraordinary Directors*—William Hunter, Lord Provost of Dundee; Sir John Ogilvy of Inverquharity, Bart.; Sir Alexander Muir Mackenzie of Delvine, Bart.; John Balfour of Balbirnie; Hugh Ballingall, Dundee; William Ogilvy Dalgleish of Errol Park; Captain Clayhills Henderson of Invergowrie; William Dingwall, Ramornie; Andrew Ralston, Glamis House; Andrew Whitton of Couston; Hon. R. Baillie Hamilton of Langton; Sir Robert Menzies of Menzies, Bart.; Colin J. Mackenzie of Portmore; George J. Walker, Portlethen; John Kerr, Broomhouse; Thomas Elliot, Blackhaugh; F. E. Villiers of Closeburn Hall; Alexander Murdoch, Gartcraig; Charles Howatson of Glenbuck; Andrew Allan, Munnoch.

Mr **Cowe** said he had only one question to ask. They all knew the principle on which the members and Directors were elected, but he would like to know on what principle the Extraordinary Directors were elected.

The **Secretary** said the rules were that ten Extraordinary Directors were chosen from the Show district where the Show was to be held. He would read the names of the gentlemen who had been chosen from the Dundee district.

Mr **Cowe** said that was quite unnecessary, as he was very well pleased with the gentlemen selected from the Dundee district.

The list of office-bearers was then unanimously approved of.

Vote of Thanks to Lord Polwarth.

The following resolution was unanimously adopted: "That the Right Hon. Lord Polwarth having presided over the Highland and Agricultural Society of Scotland during the past year, the thanks of the Society are due to his Lordship for the zeal exhibited by him in promoting its efficiency and prosperity, for presiding at the General Meeting of members held at Melrose on the occasion of the General Show held there, and for the dignity, urbanity, and ability with which he discharged the duties of the office of President."

Finance.

Mr **James Auldjo Jamieson** submitted the accounts for the year 1888-89. These showed the income for the year to have been £6321, 16s. 7d., and the expenditure £6467, 8s. 4d., being an excess of expenditure of £145, 11s. 9d. The general funds of the Society now amount to £66,212, and the building fund to £3539. In presenting the accounts, Mr Jamieson said they were of a very satisfactory character, and to a very large extent that result had been achieved by the exertions of the Committee appointed to supervise the expenditure of the Society. For some years the expenditure had been very much larger than the income, and it might soon have encroached very seriously on their capital, and diminished the power of the Society, had a check not been instituted.

THE ARGYLL NAVAL FUND.

The SECRETARY submitted the accounts of the Argyll Naval Fund, which showed the income to have been £247, 7s. 10d., and the expenditure, in allowances to five recipients, £200. The Fund stands at £6468. One of the recipients having been ten years on the list, now retires from the Fund, and is succeeded by Mr Godfrey W. Webster, the senior candidate on the list.

The accounts were approved.

MELROSE SHOW, 1889.

Mr STIRLING of Kippendavie said: After the detailed reports which have already been published in regard to the late Show at Melrose, it is unnecessary for me to occupy the time of the meeting with more than a brief statement of the results. All the favourable anticipations entertained of the meeting were fully realised. For the first time for many years the weather was propitious; the attendance from the surrounding districts was consequently very great, and a degree of interest was excited equal to any former meeting of the Society. The stock generally was of a superior character, and the implements and other articles brought forward were highly satisfactory. The Society was fortunate in having had the presence of its President, Lord Polwarth, at the General Meeting held in the Showyard; and although prevented, by the death of a near relative, from attending the dinner, his Lordship took a warm interest in the success of the meeting. From the accounts which have just been submitted, it will be seen that the receipts from all sources amounted to £4789, 9s. 10d., and the general expenses to £3378, 7s. 8d., leaving a balance of £1411, 2s. 2d. to pay the premiums, amounting to £2140, 1s. 8d., making an estimated loss of £728, 19s. 6d., as compared with a deficit of £1531 on the Show held at Kelso in 1880.

DUNDEE SHOW, 1890.

Mr STIRLING then said:—

For the second time in the history of the Society the General Show is this year to be held at Dundee. On the first occasion, in 1843, the premium-list did not amount to more than £900. Now, the list which I have on this occasion to submit amounts to £1989, given by the Society. Of this sum, £745 will be offered for cattle; £474 for horses; £381 for sheep; £69 for swine; £96 for poultry; £54 for dairy produce; £160 for implements, Highland industries and fisheries, and extra stock. Special prizes, amounting to £159, will also be offered, as follows: Two prizes of £25 each, given by the Clydesdale Horse Society, Glasgow—one for the best Clydesdale stallion and the other for the best Clydesdale mare,—the only restriction on these premiums is, that animals competing for them must be registered in the Clydesdale Stud-book; £25, given in five prizes, by Mr Gilmour of Montrave, the Scotch representative on the Royal Commission on Horse Breeding, for yearlings, the produce of the Queen's premium stallions that have served in Scotland; £24, given by Mr Macpherson Grant of Drumduan, for three-year-old Aberdeen-Angus cows; £10, given by Miss Morison Duncan of Naughton, for best Aberdeen-Angus bull; £10, given by Mrs Morison Duncan of Naughton, for best female animal of the Aberdeen-Angus breed. The Tweeddale gold medal, of the value of £20, will be given for the best Border Leicester tup; and £20, from Mr Ogilvy Dalgleish of Errol Park, for best Highland bull and best female animal of the Highland breed.

I may also refer to certain alterations which have been adopted by the Directors in the showyard regulations. Animals in the yard all Monday will get full rations, those arriving after twelve noon half rations. No rug will be allowed to be hung up so as to conceal any animal in a horse-box or stall, except with permission of the steward of that department. Then, as to management of the showyard, the Directors have adopted the following rules:—

"1. That the Show be managed entirely by a Board, consisting of the Secretary and six stewards—viz., one for horses, one for cattle, one for sheep, swine, &c., one for forage, and two for implements. These stewards to be elected at the Directors' meeting in April.

"2. That the stewards be more permanent than they are at present.

"3. That this Board meet morning and evening to make such arrangements as they may consider necessary for the conduct of the Show. All orders to proceed from this Board, and each steward to be responsible for his own department.

"4. That these stewards are to commence their duties not later than noon on the Monday of the Show week, and, except with the consent of the Board of Stewards, are all expected to remain till the close of the Show.

"5. That three foremen be engaged: one for cattle, one for horses, and one for all other stock. That a room be provided for each of these foremen in the yard, and convenient to their respective classes of stock; and that they be solely under the orders of their respective stewards.

"6. That the Clerk of Works, acting under the Secretary, be responsible for the tidiness and cleanliness of the yard outside the sheds."

With reference to the Committee appointed last summer to visit Dundee, on the subject of raising a voluntary subscription, I may state that the Committee went there on the 30th of August, when they met a large number of gentlemen—municipal authorities and representative citizens—and that after a good deal of conversation, the conference was closed with the understanding that efforts would be made to raise a voluntary subscription throughout the city and neighbourhood. I have only further to state that the Show will be held on the 29th, 30th, and 31st July, and 1st August.

SUBSCRIPTIONS FROM DUNDEE.

Mr **STIRLING** said the Committee appointed to visit Dundee to arrange about the subscriptions from Dundee had been entertained to a very excellent lunch. The Committee were supplied with plenty of champagne, but he was afraid their Dundee friends had not gone much further in the raising of subscriptions. Champagne may be a very good thing in its way, but when supplied to Committees it did not fill the coffers of the Society. He hoped that they would soon hear of a subscription being raised by their Dundee friends.

Mr **MACDUFF** of Bonhard said that in referring to this matter Mr Stirling always dwelt upon the excellent lunch the Committee had received. Mr Stirling's mind always seemed to gravitate back to that lunch. He (Mr Macduff), however, was able to say that a subscription list had already been opened, and he was pretty well assured that a very considerable sum would be raised in the Dundee district towards the Show.

Mr **COWE**, Balhousie, said that he had suggested to the Dundee Magistrates that they ought to entertain the Directors during their stay in Dundee.

The **EARL OF HADDINGTON** said that was a very good suggestion, and the Directors would be glad to accept of their Dundee friends' hospitality.

AGRICULTURAL EDUCATION.

Mr **MACKENZIE** of Portmore reported that the second examination of candidates for bursaries under the new by-law took place simultaneously at Edinburgh and Glasgow on the 17th October, when seven gentlemen presented themselves. The following were found entitled to bursaries of £20 each: 1. James M'Kinnell, Kilmartin, Lochgilphead; 2. John Murray, The Muir, Laurencekirk; 3. William Henderson, 34 Upper Gray Street, Edinburgh. Mr Mackenzie further reported that the examination of candidates for the Society's Agricultural Certificate and Diploma, and for the Certificates in Forestry, had been fixed for the 26th, 27th, and 28th March, candidates being required to lodge intimation before the 18th March.

REPORT BY CHEMIST.

Dr **AITKEN** said:—

During the past year eighteen analytical associations have sent in to the Society returns of the analyses made for them by their various analysts. This is the largest number of associations that have sent returns in any one year. The number of analyses for which the Society's grant is claimed amounts to 246. Besides these, there are eleven analyses which ought to have been included in last year's returns, but which were sent in too late to be received by the Committee. The total amount of the grant proper to the year is £102, 15s., but, including the arrears of last year, it amounts in all to £107, 15s., for a total of 257 analyses.

The number of samples which have been found deficient from their guarantees consists of ten manures and four feeding stuffs. The Chemical Committee have investigated the circumstances in connection with these deficiencies, and find that in twelve cases they admit of satisfactory explanation, and require no further notice on their part; while in the case of the remaining two it may be found necessary to publish the details in the forthcoming volume of the 'Transactions.' The associations which during the last year have shown the greatest activity are those of Wester Ross and Turriff, each of which has sent in upwards of thirty schedules of analyses accurately filled up, and have obtained grants of £12, 10s. and £15 respectively.

Investigations.—During the past year a great increase has been made in the number of agricultural experiments carried on by local associations throughout the country. The manurial experiments number upwards of a hundred, and these have been carefully carried out under the superintendence of local committees. The reports have not all been received as yet, but those that have come to hand bear evidence of the great amount of care that has been bestowed upon them. The most of them relate to the manuring of the turnip crop; and their main object has been to discover what is the most economical kind of manure that can be used for that crop in the various districts and on the various soils occupied by the investigators. Full details of these experiments will be published in the 'Transactions,' and it would be out of place to refer to them here in any but the most general terms. I may say, however, that one general result has been to show that in so far as the turnip crop is concerned, the cheapest manures have not only been the most economical, but, apart from the price, they have been the most efficacious.

Founding upon the information derived from these experiments, and following up the line of investigation, a schedule has been prepared describing an experiment which it is hoped will be widely taken up by farmers over the country this month or next. It is a simple experiment to determine whether a mixture of superphosphates and sulphate of ammonia, or a mixture of Thomas slag and nitrate of soda, is most economical; secondly, to discover what proportion the nitrogenous manure should bear to the phosphate; and thirdly, to discover whether these mixtures may be applied in winter as usefully as in the drills at the time of sowing. If it were found that the winter application were as useful as manuring in the drills, the practice would be most valuable to the farmer in relieving the great strain of labour that occurs at the time of turnip-sowing. The reason why these two mixtures have been selected is, that the two phosphates concerned were found in last year's experiments to be the most economical. As to the nitrogenous manures, nitrate of soda and sulphate of ammonia, they are the substances which rule the price of nitrogen compounds in the manure market, and for that, among other reasons, they have been selected. In some respects, it would have been better if only one of them had been selected, but sulphate of ammonia cannot be mixed with Thomas slag without loss, and nitrate of soda, when mixed with superphosphate, unless in small proportions, is attended not only with loss, but in some circumstances with danger. On the other hand, sulphate of ammonia and superphosphate may be mixed without loss or harm, and so may nitrate of soda and Thomas slag. It may be objected that the application of nitrate of soda during the winter months will be attended with loss of nitrate during the winter fallow. How far that may occur remains to be seen. In any case the lesson will be a useful one, and it is not expensive.

Besides these manurial experiments there have been carried out in a very thorough-going manner six feeding experiments with various objects in view. In all, eighty-four cattle have been under special dieting and observation, and their weight has been ascertained every four weeks during four and sometimes five months. The information conveyed by these trials cannot be stated in a sentence, and will require to be read in the light of the many details and analyses which will be found in the reports which will appear in the 'Transactions.'

BOTANICAL REPORT.

Mr **M'Alpine**, the Society's Botanist, reported that the work of seed-testing has now begun, but, as yet, few samples have been examined. Two different samples of meadow fescue showed remarkably low germination—in one case 21 per cent, in another 32. Normal samples of this fescue germinate between 90 and 100 per cent. Other samples examined showed good germinating power. For example:—

	Germination. Per cent.
Cocksfoot	78.93
Tall fescue	90
Hard fescue	87
Meadow foxtail	76

During the past year a number of members sent in samples of grasses to be named: this shows that farmers in Scotland are beginning to take a more active and personal interest in the grass question than hitherto. He had made a qualitative and quantitative analysis of between fifty and sixty pastures in different districts of Scotland, and as the results will appear in the 'Transactions,' he thought it unnecessary to dwell upon them here. He mentioned, however, that the amount of meadow fescue and perennial ryegrass in old pastures is remarkably low, while the amount of agrostis, crested dogstail, and Yorkshire fog is remarkably high, these three latter forming the main bulk of the pastures he had examined.

The **Secretary** stated that the Directors, considering the satisfactory nature of the grass experiments, had voted £50 this year for their continuance.

The report and the action of the Directors were approved.

FORESTRY DEPARTMENT.

Sir **Robert Menzies** reported that the following memorial, as to the establishment of a Board of Forestry, had been forwarded to the President of the Board of Agriculture:—

"Unto the Right Hon. HENRY CHAPLIN, M.P.,
President of the Board of Agriculture.

"The memorial of the Highland and Agricultural Society of Scotland showeth: That your memorialists, as representing the landed proprietors and others in Scotland, are much interested in the subject of forestry and the growth of timber as a valuable product. That your memorialists understand that the Board of Forestry is to be a department under the Board of Agriculture. That your memorialists are aware that there is a recommendation by a Parliamentary Committee that a Board of Forestry should be appointed and a School of Forestry established. That your memorialists understand that nothing has as yet been done to carry out that recommendation. Your memorialists would therefore humbly pray that, both in the interests of forestry and the country at large, immediate steps be taken for the formation of a Board of Forestry and the establishment of Forestry Schools."

DAIRY DEPARTMENT.

Mr **ALLAN**, Munnoch, reported, on behalf of the Dairy Department, that none of the £100 had been given to the local dairy associations this year, as those associations which had been actively engaged in carrying on dairy instruction had received liberal grants from the Board of Agriculture. The Dairy Department recommended that the whole of the £100 grant should be given to the Kilmarnock Dairy School, which, notwithstanding its unqualified success, only received the small grant of £100 from the Board of Agriculture. Over 1400 pupils attended during last season, and received instruction in cheese and butter making, which he thought must result in greatly raising the quality of the dairy produce throughout the country. No institution or association in Scotland receiving Government grants had done so much good and useful work as the Kilmarnock Dairy School. He had much pleasure in reporting that the British Dairy Farmers' Association visited the dairy districts in the south-west of Scotland in June, and, favoured with fine weather and unbounded hospitality, their visit was a great success, and gave much pleasure and satisfaction to the visitors, and also to the dairy farmers of the district who attended the conference. He was glad to say the quality of Scotch cheddar cheese had been so much improved that some of the principal prizes at the London Dairy Show for the last two years had been taken by Scotch cheese exhibited by tenant-farmers. Several competitors had entered for the Acidity prize, but the judging of the different tests had been delayed till the spring.

It was agreed to continue the grant of £100 in connection with the Dairy Department for another year.

REPORT ON ABORTION IN ANIMALS.

The **SECRETARY** said: On the part of the Veterinary Department, I have to submit the following report by the Committee on Abortion:—

"The Committee intrusted with the investigation into the cause of epizootic abortion have been directing their attention to the question, 'Is the disease an infectious one? and if so, is there a special organism concerned in its propagation?' The result of their investigation has been to lend additional support to the view that the disease is micro-organismal, and a number of organisms have been cultivated and isolated from the discharges of cows that have aborted; but it has not been proved that any of these exist in the tissues of the uterus. They are of opinion that the next step should be to study minutely the pathology of this disease, for this has not yet been done. The work to be undertaken would be somewhat as follows: 1st, To ascertain what structural alteration, if any, in the uterus or placenta, or fœtus or its envelopes, underlies abortion. 2d, To discover whether demonstrable germs are present in the uterine cavity, or wall, or fœtus before abortion. 3d, To ascertain the state of the uterus structurally, as regards the presence of germs at a certain period after abortion. 4th, To continue, on a larger scale, attempts to excite abortion by the introduction of the organisms already isolated from the discharges, or which may be found in the tissues of aborted cows into the genital passages of healthy cows, or otherwise. The probable cost of such an investigation, carried out on a sufficiently large scale, would not exceed £300."

When this report was submitted to the Veterinary Committee they recommended the Directors to vote £100 towards the investigation, provided £200 more could be obtained from individual and local societies' subscriptions. The report came before the Directors on 4th December last, when, after discussion, during which the President (Lord Polwarth) offered to subscribe £20, the following Committee was appointed to raise subscriptions: Lord Polwarth; Sir James H. Gibson-Craig, Bart.; Mr M'Queen of Crofts; Mr Walker, Portlethen; Mr Cran, Kirkton; Mr Mackenzie, Dalmore; Mr Allan, Munnoch; and Mr R. F. Dudgeon, The Grange, Kirkcudbright, convener. The matter is now in the hands of this Committee, and several subscriptions have already been intimated. I may further state that a short summary of the antiseptic precautions recommended by Professor Nocard is to be drawn up and published in the Society's 'Transactions,' and circulated as a leaflet among local agricultural societies in Scotland.

PREMIUMS FOR REPORTS.

Dr **CLEGHORN** of Stravithy, in the absence of the Rev. John Gillespie, Convener of the Committee on Publications, reported the premiums awarded for reports lodged in November 1889, and those offered in 1890.

The report was adopted.

DISTRICT SHOWS AND COTTAGES AND GARDENS.

Mr **BUTTAR**, Corston, said: I have to report that during the past year the Society's money premiums and medals have been in operation in 253 districts—namely: stock, 28; special grants, 4; medals in aid of premiums given by local agricultural associations, 31; ploughing competitions, 154; cottages and gardens, 36. The total sum awarded amounted to £250. The arrangements made for the current year embrace the usual premiums to 23 districts for stock; special grants, 5; medals to local societies, 44 districts; besides the plough medal, which is given under certain conditions without previous application. For cottages and gardens, 2 districts at £3 each; and 18 districts at two minor silver medals each. It is also proposed to continue the offer of two gold medals (£10 each)—one to the proprietor in Scotland who shall report the improvement of the greatest number of cottages during 1887, 1888, and 1889; the other to the proprietor in Scotland who shall report the erection of the greatest number of approved cottages during the years 1886, 1887, 1888, and 1889. It is to be hoped that in awarding these prizes special stress will be laid upon the question of sanitary arrangements, including drainage, ventilation, and supply of pure water. The total sum offered amounts to £406, 13s. 10d.

PLEURO-PNEUMONIA.

The **SECRETARY** stated that a large deputation, representing a great many agricultural bodies in England, was to wait on the President of the Board of Agriculture on 5th February, and Major Craigie, Secretary of the Central Chamber of Agriculture, had requested that representatives of the Highland Society should join the deputation. The object of the deputation was to press upon Mr Chaplin the desirableness of confiding to a central authority the administration of the Contagious Diseases (Animals) Act, so far as they relate to compulsory slaughter and the treatment and control of affected animals, coupling that change with the indispensable condition that compensation in cases of slaughter should be provided from the Imperial Exchequer. The Directors requested Mr Stirling to represent the Society on the deputation, along with any other members of the Society who might find it convenient to attend.

This was agreed to.

On the motion of Sir **ROBERT MENZIES**, the Earl of Haddington was thanked for presiding, and the meeting terminated.

PREMIUMS AWARDED BY THE SOCIETY IN 1889.

I.—REPORTS.

1.	John Speir, Newton Farm, Newton, Glasgow, for a Report on Change in Cropping to suit Altered Conditions of Farming	£15	0	0
2.	Dr William Somerville, B.Sc., F.R.S.E., Lecturer on Forestry, Edinburgh University, for a Report on the Growth of Trees	10	0	0
3.	D. Tallerman, 50 Redcliffe Road, South Kensington, London, for a Report on Railway Refrigerator Trucks or Cars	10	0	0
4.	W. Anderson Smith, Ledaig, for a Report on Marine Life destroyed by the Trawl, and its Influence on Fish Life	5	0	0
5.	James G. Bertram, 334 St Vincent Street, Glasgow, for a Report on Trawl Net Fishing: its Effects on Marine Life	5	0	0
6.	Robert Hutchison of Carlowrie, for a Report on the Cedar of Lebanon	5	0	0
7.	Robert Hutchison of Carlowrie, for a Report on the Varieties of Trees best adapted for Planting as Shelter in the Islands of Scotland	2	10	0
8.	A. D. Webster, Hollydale, Keston, Kent, for a Report on the same subject	2	10	0
		£55	0	0

II.—MELROSE SHOW, 1889.

Class I.—CATTLE.

SHORTHORN.

TWEEDDALE GOLD MEDAL. *Best Shorthorn Bull* in the Yard.

William Duthie of Collynie, Tarves, "Paragon Baron"	£18	5	8
Best Female. Given by the Duke of Portland.—The Duke of Buccleuch and Queensberry, K.T., Dalkeith, "Fair Maid"	15	0	0
Breeder of Best Bull. John Garne, Great Rissington, R.S.O. Silver Medal	0	14	0

Section 1. BULL, calved before 1st January 1887.

1.	John Handley, Greenhead, Milnthorpe, "Macbeth" (54,676)	20	0	0
2.	James Carnegie, Aytounhill, Newburgh, Fife, "Lovat Fancy" (53,238)	10	0	0

Section 2. BULL, calved on or after 1st January 1887.

1.	William Duthie of Collynie, Tarves, "Paragon Baron"	15	0	0
2.	John Handley, Greenhead, Milnthorpe, "Lord Frederick" (56,045)	10	0	0
3.	Robert Thompson, Inglewood, Penrith, "Master Smartly 7th" (56,164)	5	0	0
H. C.	—James Douglas Fletcher of Rosehaugh, Inverness, "Duke of Brailes 14th." C.—Lord Polwarth, Mertoun, St Boswells, "Dauntless."			

Section 3. BULL, calved on or after 1st January 1888.

1.	Thomas Willis, Manor House, Carperby, Bedale, "Heir of Windsor"	12	0	0
2.	Robert Thompson, Inglewood, Penrith, "Baron Swaledale"	8	0	0
3.	William Duthie of Collynie, Tarves, "Royal Star"	4	0	0
H. C.	—A. Robertson, Haugh of Ballechin, Ballinluig, "Macduff." C.—Lord Polwarth, Mertoun, St Boswells, "Dreadnought."			
	Carry forward	£117	19	8

Brought forward	£117	19	8

SECTION 4. COW, of any Age.

1. The Duke of Buccleuch and Queensberry, K.T., Dalkeith, "Fair Maid"	12	0	0
2. Lord Polwarth, Mertoun, St Boswells, "Wave of Loch Leven"	8	0	0
3. Robert Thompson, Inglewood, Penrith, "Inglewood Gem"	4	0	0

H. C.—Lord Polwarth, Mertoun House, St Boswells, "Merry Foggathorpe." C.—Trustees of Sir Richard George Musgrave, Bart., Eden Hall, "Diamond 13th." C. — Lord Polwarth, "Princess Foggathorpe."

SECTION 5. HEIFER, calved on or after 1st January 1887.

1. Lord Polwarth, Mertoun House, St Boswells, "Wave of Indiana"	10	0	0
2. Lord Polwarth, "May Foggathorpe"	5	0	0
3. J. Graham Stirling, of Strowan, Crieff, "Strowan Marchioness"	3	0	0

SECTION 6. HEIFER, calved on or after 1st January 1888.

1. Robert Thompson, Inglewood, Penrith, "Windsor's Beauty"	10	0	0
2. Lord Polwarth, Mertoun, St Boswells, "Truth"	5	0	0
3. Lord Polwarth, Mertoun, St Boswells, "Wave Crest"	3	0	0

C.—W. & T. Bain, Legers, Kelso, "Bessie Lee 9th."

AYRSHIRE.

Best Bull. Given by the Duke of Portland.—Robert Montgomerie, Lessnessock, Ochiltree, "Glencairn of Lessnessock" (1818)	10	0	0
Best Female. Given by the Duke of Portland.—Robert Wilson, Manswrae, Kilbarchan	10	0	0
Breeder of Best Bull. Robert Montgomerie, Lessnessock, Ochiltree Silver Medal	0	14	0

SECTION 7. BULL, calved before 1st January 1887.

1. Stand Stud Company, Whitefield, Manchester, "Young Hover a Blink"	15	0	0
2. Andrew Mitchell, Barcheskie, Kirkcudbright, "Traveller" (1441)	10	0	0

SECTION 8. BULL, calved on or after 1st January 1887.

1. R. Montgomerie, Lessnessock, Ochiltree, "Glencairn of Lessnessock" (1818)	12	0	0
2. M. Templeton, Dromore, Kirkcudbright, "Scotch Thistle" (1576)	8	0	0
3. Andrew Allan, Munnoch, Dalry, "Carstone of Munnoch"	5	0	0

V. H. C.—John M'Kean, Ballewan, Strathblane, "John o' Groat."

SECTION 9. BULL, calved on or after 1st January 1888.

1. Robert Wardrop, Garlaff, Cumnock, "Father O'Flynn"	8	0	0
2. M. Templeton, Dromore Farm, Kirkcudbright, "Look at Me"	5	0	0
3. Robert Wardrop, Garlaff, Cumnock, "Prince Albert"	3	0	0

C.—W. Connel Black, of Kailzie, Peebles, "Waterloo."

SECTION 10. COW in Milk, of any Age.

1. Walter S. Park, Hatton, Bishopton, "Bramble"	12	0	0
2. John Meikle, Grougfoot, Linlithgow, "Jennie"	8	0	0
3 John M'Kean, Ballewan, Strathblane, "Jessie"	4	0	0

V. H. C.—And. Mitchell, Barcheskie, Kirkcudbright, "Lizzie of Barcheskie."

SECTION 11. COW in Calf, of any Age.

1. Robert Wilson, Manswrae, Kilbarchan	12	0	0
2. R. H. Walker, Hartwood, West Calder, "Favourite IV." (2814)	8	0	0
3. And. Allan, Munnoch, Dalry, "Blossom 2d of Munnoch" (1331)	4	0	0

H. C.—John Stewart, 128 Bellfield Street, Glasgow, "Beauty." C.—And. Mitchell, Barcheskie, Kirkcudbright, "Ripple of Barcheskie."

Carry forward	£312	13	8

Brought forward . .	£312	13	8

SECTION 12. HEIFER, calved on or after 1st January 1887.

1. And. Mitchell, Barcheskie, Kirkcudbright, "Nellie" (5992) . .	10	0	0
2. R. H. Walker, Hartwood, West Calder, "Kate of Hartwood" .	5	0	0
3. Stand Stud Company, Whitefield, Manchester	3	0	0

V. H. C.—Andrew Mitchell, Barcheskie, Kirkcudbright, "Lucy." H. C.—Rob. Wardrop, Garlaff, Cumnock, "Lady of the Lake."

SECTION 13. HEIFER, calved on or after 1st January 1888.

1. Andrew Allan, Munnoch, Dalry, "Dina 5th"	8	0	0
2. M. Templeton, Dromore, Kirkcudbright, "Primrose 2d" (5933) .	5	0	0
3. Robert Wardrop, Garlaff, Cumnock, "Laura Lee"	3	0	0

V. H. C.—Andrew Mitchell, Barcheskie, Kirkcudbright, "Brownie 6th" (5537). H. C.—Andrew Allan, Munnoch, Dalry, "Aggie 4th."

ABERDEEN-ANGUS.

Breeder of Best Bull.—Sir George Macpherson Grant of Ballindalloch, Bart. . . . . Silver Medal	0	14	0

SECTION 14. BULL, calved before 1st December 1886.

1. And. Mackenzie, Dalmore, Alness, "Esquire" (5346) . . .	20	0	0
2. Sir George Macpherson Grant, Bart., Ballindalloch, "Plutarch" (5632)	10	0	0
3. Alex. Strachan, Wester Fowlis, Alford, N.B., "Champagne" (4565).	5	0	0

SECTION 15. BULL, calved on or after 1st December 1886.

1. Arthur Egginton, South Ella, Hull, "Ensign of Guisachan" (6011) .	15	0	0
2. James Wilson, Inchgower, Fochabers, "Entail" (6012) . .	10	0	0
3. Colin J. Mackenzie, Eshiels, Peebles, "Euclid of Guisachan" (6031) .	5	0	0

C.—J. D. Fletcher of Rosehaugh, Inverness, "Lord Fitzroy" (6911). W. Watt, Dura Mains, Cupar Fife, "Snawdoun."

SECTION 16. BULL, calved on or after 1st December 1887.

1. J. D. Fletcher of Rosehaugh, Inverness, "Prince of Euston" . .	12	0	0
2. Lord Tweedmouth, Guisachan, Beauly, "Field Marshal of Guisachan" (6727)	8	0	0
3. The Earl of Strathmore, Glamis Castle, "Figaro" (6728) . .	4	0	0

V. H. C.—Miss Morison Duncan, Naughton, Newport, Fife, "Emperor Frederick" (6694).

SECTION 17. COW, calved before 1st December 1885.

1. Sir George Macpherson Grant, Bart., Ballindalloch, "Elegy" (7046).	12	0	0
2. Miss Morison Duncan, Naughton, Newport, Fife, "Melissa Grace" (10,569)	8	0	0
3. Sir George Macphersen Grant, Bart., Ballindalloch, "Eloquence" (11,207)	4	0	0

V. H. C.—D. S. Porteous, Lauriston, Montrose, "Governess" (10,335).

SECTION 18. COW, three years old. Given by Mr Macpherson Grant of Drumduan.

1. Sir George Macpherson Grant, Bart., Ballindalloch, "Equality" (11,208)	12	0	0
2. Col. G. A. Ferguson of Pitfour, Mintlaw, "Miss Pretty" (12,313) .	8	0	0
3. Col. G. A. Ferguson of Pitfour, Mintlaw, "Sunbeam 4th" (12,317) .	4	0	0

V. H. C.—A. Egginton, South Ella, Hull, "Waterside Black Bell" (11,951).

SECTION 19. HEIFER, calved on or after 1st December 1886.

1. And. Mackenzie, Dalmore, Alness, "Attraction 2d" (12,616) . .	10	0	0
2. The Earl of Strathmore, Glamis Castle, "Bridesmaid" (13,135) .	5	0	0
3. A. Egginton, South Ella, Hull, "Violet of Benton" (13,090) . .	3	0	0

V. H. C.—And. Mackenzie, Dalmore, Alness, "Paris Princess" (12,624). H. C.—Lord Tweedmouth, "Pride of Guisachan 20th" (13,161).

Carry forward . .	£502	7	8

Brought forward	£502	7	8

SECTION 20. HEIFER, calved on or after 1st December 1887.

1. Lord Tweedmouth, "Fame of Guisachan" (14,404)	10	0	0
2. And. Mackenzie, Dalmore, Alness, "Lady Ida 5th" (13,911)	5	0	0
3. Sir George Macpherson Grant, Bart., "Black Pearl of Ballindalloch" (13,698)	3	0	0
V. H. C.—And. Mackenzie, Dalmore, "Lady Grace 6th" (13,909). H. C.—Miss Morison Duncan, Naughton, "Star of Jubilee" (13,567). C.—The Earl of Strathmore, "Ethel of Glamis" (14,385).			

GALLOWAY.

Breeder of Best Bull.—F. E. Villiers, Closeburn Hall, Thornhill Silver Medal	0	14	0

SECTION 21. BULL, calved before 1st January 1887.

1. F. E. Villiers, Closeburn Hall, Thornhill, "Vale Royal of Closeburn" (3804)	20	0	0
2. Sir Robert Jardine of Castlemilk, Bart., M.P., "Liberator of Balig" (3850)	10	0	0
3. J. Cunningham, Tarbreoch, Dalbeattie, "Lucky Times" (3058)	5	0	0
V. H. C.—The Duke of Buccleuch and Queensberry, K.T., "The Squire of Drumlanrig" (3737). H. C.—The Duke of Buccleuch and Queensberry, K.T., "Vich Ian Vhor" (4121). C.—Jas. Cunningham, Tarbreoch, "Royal Liberty" (4140).			

SECTION 22. BULL, calved on or after 1st January 1887.

1. James Cunningham, Tarbreoch, "Macdougall of Tarbreoch" (4436)	15	0	0
2. T. Biggar & Sons, Chapelton, Dalbeattie, "Crusader King" (4506)	10	0	0
3. The Duke of Buccleuch and Queensberry, K.T., Drumlanrig, "Royal Prince" (4401)	5	0	0
V. H. C.—Sir R. Jardine of Castlemilk, Bart., M.P., "Bard of Castlemilk" (4416). H. C.—Sir Robert Jardine, Bart., Lanrick Castle, "Royal Jubilee Liberty" (4421).			

SECTION 23. BULL, calved on or after 1st January 1888.

1. J. Robertson, Burnfoot, Hawick, "Henry of Tarbreoch" (4847)	12	0	0
2. F. E. Villiers, Closeburn Hall, Thornhill, "Hossack of Tarbreoch" (4850)	8	0	0
3. Lord Polwarth, Harden, Hawick, "Tidy Lad" (4947)	4	0	0

SECTION 24. COW, of any Age.

1. J. Cunningham, Tarbreoch, Dalbeattie, "Maggie of Tarbreoch" (8613)	12	0	0
2. The Duke of Buccleuch and Queensberry, K.T., "Pride of Drumlanrig" (6988)	8	0	0
3. F. E. Villiers, Closeburn Hall, "Vaudeville of Closeburn" (8134)	4	0	0
V. H. C.—Sir R. Jardine of Castlemilk, Bart., M.P., "Sonsy Lass" (10,268). H. C.—Sir R. Jardine, Bart., M.P., Lanrick Castle, "Mistletoe" (9543). C.—J. Cunningham, "Bella 2d of Tarbreoch" (8928). James Cunningham, "Tarbreoch Lizzie 3d" (9680).			

SECTION 25. HEIFER, calved on or after 1st January 1887.

1. T. Biggar & Sons, Chapelton, Dalbeattie, "Violet 2d" (10,509)	10	0	0
2. The Duke of Buccleuch and Queensberry, K.T., "Pride 4th of Drumlanrig" (10,337)	5	0	0
3. The Duke of Buccleuch and Queensberry, K.T., "Beauty of Drumlanrig" (10,321)	3	0	0
V. H. C.—T. Biggar & Sons, Chapelton, Dalbeattie, "Clara 6th" (10,513). H. C.—T. Biggar & Sons, "Countess of Ailsa" (10,514). C.—F. E. Villiers, "Vaccine 2d of Closeburn" (10,438).			
Carry forward	£652	1	8

Brought forward . .	£652	1	8

SECTION 26. HEIFER, calved on or about 1st January 1888.

1. Lord Polwarth, Harden, Hawick, "Emerald of Nether Hall" (11,397)	10	0	0
2. J. Cunningham, Tarbreoch, "Madonna 2d of Tarbreoch" (11,056) .	5	0	0
3. The Duke of Buccleuch and Queensberry, K.T., "Favourite 3d of Drumlanrig" (10,957)	3	0	0
V. H. C.—Sir R. Jardine, Bart., M.P., "Model 2d of Castlemilk" (10,980). H. C.—Sir Robert Jardine, Bart., M.P., "Lady Isabella Douglas 2d of Castlemilk" (10,983). C.—T. Biggar & Sons, Chapelton, Dalbeattie, "Countess of Murray 2d" (11,368). F. E. Villiers, "Verbena 3d of Closeburn" (11,041).			

HIGHLAND.

Breeder of Best Highland Female Animal. Given by the Earl of Southesk, K.T., President of the Highland Cattle Society.—John Stewart, Bochastle, Callander, "Proiseag Dubh" (451) . Silver Cup	11	0	0
Breeder of Best Bull.—John Stewart of Ensay, Obbe, Portree, "Cearnach" (642) . . . . . . Silver Medal	0	14	0

SECTION 27. BULL, calved before 1st January 1887.

1. John Stewart of Ensay, Obbe, Portree, "Cearnach" (642) . .	20	0	0
2. John Malcolm of Poltalloch, Lochgilphead, "Iain Challum" (667) .	10	0	0
3. John Malcolm of Poltalloch, "Kilchoan 2d" (670) . . .	5	0	0
V. H. C.—The Earl of Southesk, K.T., Kinnaird Castle, Brechin, "Alan of Southesk" (627). H. C.—T. V. Smith of Ardtornish, Oban, "An-T-Iasgair" (13). C.—Alex. Macdonald, Balranald, Lochmaddy, "Lord Nelson" (676).			

SECTION 28. BULL, calved on or after 1st January 1887.

1. John Stewart of Ensay, Obbe, Portree, "Scarbhaidh" . . .	15	0	0
2. The Duke of Sutherland, K.G., Shinness, Lairg, "Lord of the Isles"	10	0	0
3. The Duke of Athole, K.T., Blair Castle, Blair Athole, "Fear-an-Tighe"	5	0	0
V. H. C.—J. Campbell of Kilberry, "Craigfeanndagach." H. C.—The Earl of Southesk, K.T., "Delaware." C.—Alex. Macdonald, Nether Largie, Kilmartin, "Duntroon."			

SECTION 29. BULL, calved on or after 1st January 1888.

1. The Earl of Southesk, K.T., "Sargon".	12	0	0
2. The Duke of Sutherland, K.G., "Glen Dubh 2d"	8	0	0
3. J. Campbell of Kilberry, "Talisman"	4	0	0
V. H. C.—The Earl of Southesk, K.T., "Paris."			

SECTION 30. COW, of any Age.

1. The Duke of Athole, K.T., Blair Athole, "Annag Riabhach" (19) .	12	0	0
2. John Malcolm of Poltalloch, "Ealasaid" (1128) . . .	8	0	0
3. Evan Macrae, Mains of Kinbeachie, Conon Bridge, "Ribhinn of Kinbeachie" (1115).	4	0	0
V. H. C.—T. V. Smith of Ardtornish, "Phroiseag 4th of Benmore" (161). H. C.—J. Campbell of Kilberry, "Baravalla" (932). C.—The Earl of Southesk, K.T., "Taragheal 8th of Harris" (1292).			

SECTION 31. HEIFER, calved on or after 1st January 1886.

1. The Duke of Athole, K.T., Blair Athole, "Tè Bhuidhe" . .	10	0	0
2. T. V. Smith of Ardtornish, "Sgiathach Dubh of Ardtornish" (1251).	5	0	0
3. T. V. Smith of Ardtornish, Oban, "Mary of Ardtornish" (1242) .	3	0	0
V. H. C.—The Earl of Southesk, K.T., "Lady Flora" (1275). H. C.—John Malcolm of Poltalloch, "Ealasaid." C.—John Malcolm of Poltalloch, "Nora."			
Carry forward . .	£812	15	8

Brought forward . .	£812	15	8

SECTION 32. HEIFER, calved on or after 1st January 1887.

1. T. V. Smith of Ardtornish, Oban, "Ban Mhuileach 2d" . .	10	0	0
2. The Duke of Sutherland, K.G., Shinness, Lairg, "Nora" . .	5	0	0
3. T. V. Smith of Ardtornish, Oban, "Sgiathach 2d" . . .	3	0	0

V. H. C.—John Malcolm of Poltalloch, "Mhaldag." H. C.—John Malcolm of Poltalloch, "Nora." C.—The Duke of Sutherland, K.G.

EXTRA CATTLE.

Very Highly Commended.

Highland Cow, "Proiseag Dubh," Thos. V. Smith of Ardtornish, Oban Medium Gold Medal	5	10	0
Blickluig Norfolk Bull, The Marquis of Lothian, K.T. Medium Gold Medal	5	10	0

Highly Commended.

Ayrshire Cow, "Lady Newbigging," W. E. Gilmour, Woodbank, Alexandria, N.B. . . . . . . Minor Gold Medal	3	6	0
Blickluig Norfolk Cow, The Marquis of Lothian, K.T. Minor Gold Medal	3	6	0

Commended.

Jersey Bull, "Blackston," W. E. Gilmour, Woodbank, Alexandria, N.B. Silver Medal	0	14	0
	£849	1	8

CLASS II.—HORSES.

FOR AGRICULTURAL PURPOSES.

Best Male. Given by the Duke of Portland.—John Gilmour of Montrave, Leven, Fife, "Prince of Albion" (6178)	£20	0	0
Best Female. Given by the Duke of Portland.—A. H. Boyle, Banknock, Bonnybridge, "Rose of Banknock"	20	0	0
Breeder of Best Male.—The late R. F. F. Campbell of Craigie, M.P., Ayr . . . . Silver Medal	0	14	0

SECTION 1. STALLION, foaled before 1st January 1886.

1. John Galbraith, Croy Cunningham, Killearn, "Lord Ailsa" (5974) .	20	0	0
2. William Taylor, Park Mains, Paisley, "Sir Everard" (5353) . .	15	0	0
3. David Riddell, Blackhall, Paisley, "Grand National" . .	10	0	0
4. The Marquis of Londonderry, Seaham Hall, "Castlereagh" . .	5	0	0

V. H. C.—David Riddell, Blackhall, Paisley, "The Tartan." H. C.—Patrick Stirling of Kippendavie, Dunblane, "Knight Errant" (4483). C.—James Drummond, Pitcorthie, Dunfermline, "Prince of the Glen."

SECTION 2. ENTIRE COLT, foaled on or after 1st January 1886.

1. John Gilmour of Montrave, Leven, Fife, "Prince of Albion" (6178) .	15	0	0
2. W. H. Lumsden of Balmedie, Aberdeen, "Royalist" (6242) . .	12	0	0
3. William Renwick, Meadowfield, Corstorphine, "Height o' Splendour" (6836)	8	0	0
4. William Montgomery, Banks, Kirkcudbright, "Ensign" (5749) .	4	0	0

V. H. C.—David Riddell, Blackhall, "Golden Avon." H. C.—Peter Crawford, Carruchan, Dumfries. C.—John Macdonald, Boquhanran, Dalmuir, "Chicago Chief" (6599).

Carry forward . .	£129	14	0

Brought forward . . £129 14 0

SECTION 3. ENTIRE COLT, foaled on or after 1st January 1887.

1. P. Crawford, Carruchan, Dumfries, "Eastfield Prince"	15	0	0
2. David Riddell, Blackhall, Paisley	10	0	0
3. Peter Crawford, Carruchan, "Eastfield Model" (6721).	6	0	0
4. W. Renwick, Meadowfield, Corstorphine, "St Stephen" (7231)	3	0	0

V. H. C.—Marquis of Londonderry. H. C.—Alexander Scott, 24 Mearns Street, Greenock, "Lord Montrose." C.—W. Renwick, Meadowfield, "Darnley's Last" (6663).

SECTION 4. ENTIRE COLT, foaled on or after 1st January 1888.

1. James Johnston, Lochburnie, Maryhill, "Orlando"	12	0	0
2. Alex. Scott, 24 Mearns Street, Greenock	7	0	0
3. W. H. Lumsden of Balmedie, "Balmedie Prince"	4	0	0
4. David M'Gibbon, Ard-na-Craig, Campbeltown	2	0	0

V. H. C.—D. Riddell, Blackhall. H. C.—George Rodger, Newton Bank, Preston Brook, "The Magician."

SECTION 5. MARE (with Foal at foot), foaled before 1st January 1886.

1. R. & J. Findlay, Springhill, Baillieston, "Chrystal" (5387)	20	0	0
2. John Galbraith, Croy Cunningham, "Topsman's Princess"	10	0	0
3. The Marquis of Londonderry, "Jeanie Darnley"	5	0	0
4. Patrick Stirling of Kippendavie, "Jessica"	3	0	0

H. C.—Lord Polwarth, Mertoun House, "Maggie III." C.—Sir John A. Hay, Bart., Kingsmeadows, "Columbine."

SECTION 6. MARE (in Foal), foaled before 1st January 1886.

1. A. H. Boyle, Banknock, Bonnybridge, "Rose of Banknock"	15	0	0
2. Ed. Charlton, Shaw House, Stocksfield-on-Tyne, "Black Bess"	10	0	0
3. R. C. Macfarlane, West Carse, Stirling, "Kate Loudon"	5	0	0
4. David M'Gibbon, Ard-na-Craig, Campbeltown, "Rhoda"	3	0	0

C.—R. H. Walker, Hartwood, West Calder, "Anemone" (7928).

SECTION 7. FILLY, foaled on or after 1st January 1886.

1. David Riddell, Blackhall, Paisley, "Sunrise"	10	0	0
2. George Alston, Loudoun Hill, Darvel, "Venora"	6	0	0
3. James Cranston, Tinwald House, Dumfries, "Tinwald Queen"	3	0	0
4. William Park, Brunstane, Portobello, "Martha"	2	0	0

H. C.—John Gilmour of Montrave, "Primrose." C.—Edward Balfour, yr. of Balbirnie, "Barmaid."

SECTION 8. FILLY, foaled on or after 1st January 1887.

1. R. Sinclair Scott, Craigievar, Skelmorlie, "Scottish Rose"	10	0	0
2. R. H. Walker, Hartwood, West Calder, "Sweetbriar"	6	0	0
3. Edward Balfour, yr. of Balbirnie, "Lady Dunmore"	3	0	0
4. David M'Gibbon, Ard-na-Craig, Campbeltown	2	0	0

V. H. C.—David M'Gibbon, Ard-na-Craig. H. C.—Lord Polwarth, Mertoun House, "Luxury."

SECTION 9. FILLY, foaled on or after 1st January 1888.

1. R. Sinclair Scott, Craigievar, Skelmorlie, "Scottish Snowdrop"	10	0	0
2. The Marquis of Londonderry, Seaham Hall	6	0	0
3. Andrew Mitchell, Barcheskie, Kirkcudbright, "Susie Macgregor"	3	0	0
4. Fergusson & Menzies, Cults, Castle Kennedy, "Conny Nairn"	2	0	0

V. H. C.—Andrew Mitchell, Barcheskie, "Daisy Macgregor." H. C.—George Waddell of Inch.

HUNTERS AND ROADSTERS.

SECTION 10. BROOD MARE, of any Age, with Foal at foot. Given by the Duke of Portland.

1. Lord Polwarth, Mertoun House, St Boswells	15	0	0
2. John W. J. Paterson, Terrona, Langholm, "Daisy"	10	0	0
3. John Robson, Newton, Bellingham, "Impatience"	5	0	0

Carry forward . . £352 14 0

Brought forward . .	£352	14	0

SECTION 11. MARE or GELDING, suitable for Field, foaled before 1st January 1886.

1. J. A. Robson Scott, Scaurs, Jedburgh, "Dorothy" . . .	12	0	0
2. W. E. Gilmour, Woodbank, Alexandria, N.B., "Pomona" . .	8	0	0
3. E. H. Maxwell Blair, Teviotbank, Hawick, "Cornucopia" . .	4	0	0
H. C.—Thomas Ramshay, The Hill, Carlisle, "Lord Limerick." C.—James Craig, Craigesk, Dalkeith, "Castle Blake."			

SECTION 12. MARE or GELDING, suitable for Field, foaled on or after 1st January 1886.

1. James Warrick, Gilbrae, Ruthwell, "Doubtless" . . .	12	0	0
2. Archibald Kerr, Upper Dormont, Lockerbie, "Valentine" . .	8	0	0
3. The Marquis of Londonderry, Seaham Hall, "Turf" . . .	4	0	0
H. C.—J. P. Robertson, Hoebridge, Melrose, "Hughenden."			

SECTION 13. MARE or GELDING, suitable for Field, foaled on or after 1st January 1887.

1. R. F. Trenholm, Howe Hills, Sedgefield, Ferryhill . . .	10	0	0
2. J. A. Robson Scott, Scaurs, Jedburgh	5	0	0
3. Robert M'William, Alstonby, Carlisle	3	0	0
H. C.—George R. Scott, Low Stokoe, Falstowe.			

SECTION 14. MARE or GELDING, suitable as Hackney, exhibited in Saddle only.

1. George T. Brown, Housen Rigg, Brayton, "Lucy Glitters" . .	8	0	0
2. Mrs Mather, Eccles House, Thornhill, "Countess" (426) . .	4	0	0
3. Peter Amos, Langton, Gainford, "Unique" (1838) . . .	2	0	0
H. C.—Mrs Cheape of Wellfield, "Boadicea." C.—J. A. Robson Scott, Scaurs, Jedburgh, "Amazon."			

SECTION 15. MARE or GELDING, suitable for Driving, 3 years old and upwards, shown in Harness and Driven.

1. J. Alfred Mather, Eccles House, Thornhill, "Ladybird" (177) .	8	0	0
2. R. H. Walker, Hartwood, West Calder, "Lady Madge" . .	4	0	0
3. George Walker, Salmon Inn, Galashiels, "Countess" . . .	2	0	0
H. C.—Andrew Hunter, Braehead House, Cathcart, "Coquette."			

SECTION 16. HORSE or MARE for Jumping.

1. David M. Reid, Kidlaw, Gifford	20	0	0
2. Edwin H. Banks, Highmoor, Wigtown, "Radical" . . .	10	0	0
3. Stuart J. Bell, Durhamhill, Dalbeattie, "Peter" . . .	5	0	0
V. H. C.—W. D. Connochie, V.S., Selkirk, "Myosotis." H. C.—Thomas Blair, Hoprig Mains, Gladsmuir, "Dalhousie."			

PONIES.

SECTION 17. STALLION, 15 Hands and under.

1. R. H. Walker, Hartwood, West Calder, "Duke of Norfolk" (1931) .	6	0	0
2. R. H. Walker, Hartwood, "Merry Sunshine" (1523) . . .	3	0	0
3. Sir John A. Hay, Bart., Kingsmeadows, "Troilus" (2297) . .	1	0	0

SECTION 18. MARE or GELDING, between 13 and 14½ hands.

1. Andrew Hunter, Braehead House, Cathcart, "Peacock" . .	6	0	0
2. Stuart Mather, Eccles House, Thornhill, "Jessamine" (1153) .	3	0	0
3. Henry Kidd, Lowood, Melrose, "Fire Fly"	1	0	0
H. C.—Mrs Mary Hayton, Cardewlees, Carlisle, "Diamond King."			

SECTION 19. MARE or GELDING, between 12 and 13 hands.

1. Alfred Mather, Eccles House, Thornhill, "Apology" . . .	6	0	0
Carry forward . .	£507	14	0

Brought forward	£507	14	0

SECTION 20. MARE or GELDING, under 12 hands.

1. Miss Mather, Eccles House, Thornhill, "Lady Pleasantrie"	6	0	0
2. John S. Heron Maxwell, Teviotbank, Hawick, "Gipsy"	3	0	0
3. Mrs Cheape, Wellfield, Strathmiglo, "Prince Onyx"	1	0	0

SHETLAND PONIES.

SECTION 21. STALLION, not exceeding 10¼ hands.

1. The Marquis of Londonderry, Seaham Hall, "Lord of the Isles"	4	0	0
2. The Marquis of Londonderry, Seaham Hall, "Multum in Parvo"	2	0	0
3. Gavin Hadden, Dalmuinzie, Murtle, "Tom Thumb"	1	0	0

H. C.—James Duncan, Fern Villa, Inverness, "Sir Henry." C.—Mrs Cheape, Wellfield, "Lord Skerry."

SECTION 22. MARE or GELDING, not exceeding 10¼ hands.

1. The Marquis of Londonderry, Seaham Hall, "Beauty"	4	0	0
2. James Duncan, Fern Villa, Inverness, "Miss Geoghegan"	2	0	0
3. Mrs Cheape, Wellfield, Strathmiglo, "The General"	1	0	0

V. H. C.—Miss Adele Hay, Gladswood, Melrose, "Peggy Sus." H. C.—Mrs Cheape, Wellfield, "Lady Skerry." C.—Mrs Cheape, Wellfield, "Folly."

SECTION 23. PONIES, 14 hands and under, for Jumping.
No Entry.

EXTRA HORSES.

Very Highly Commended.

Hunter, Gelding, "Walton," W. E. Gilmour, Woodbank, Alexandria	Medium Gold Medal	5	10	0

Commended.

Hunter, Mare, C. H. Scott Plummer, Sunderland Hall,	Silver Medal	0	14	0
Thoroughbred Stallion, "Strathkinness," R. B. Hay and Sir John A. Hay, Bart., Kingsmeadows	Silver Medal	0	14	0
		£538	12	0

CLASS III.—SHEEP.

BLACKFACED.

SECTION 1. TUP, 3 Shear and upwards.

1. John Archibald, Overshiels, Stow	£12	0	0
2. John Archibald, Overshiels, Stow	8	0	0
3. Charles Howatson of Glenbuck, Glenbuck	4	0	0

V. H. C.—John Archibald. H. C.—R. Sinclair Scott, Flatt Farm, Largs.

SECTION 2. TUP, 2 Shear.

1. John Archibald, Overshiels, Stow	12	0	0
2. John Archibald, Overshiels, Stow	8	0	0
3. Charles Howatson of Glenbuck, Glenbuck	4	0	0

V. H. C.—Alexander Clark, Todlaw. H. C.—The Duke of Argyll, K.G., Ballymenach. C.—R. & J. Cadzow, Borland, Biggar.

SECTION 3. SHEARLING TUP.

1. John Archibald, Overshiels, Stow	12	0	0
2. Alexander Clark, Todlaw, Lesmahagow	8	0	0
3. John Archibald, Overshiels, Stow	4	0	0

V. H. C.—John Archibald. H. C.—John Archibald. C.—Alexander Clark, Todlaw. Charles Howatson of Glenbuck.

Carry forward	£72	0	0

Brought forward . . £72 0 0

SECTION 4. Three EWES, above 1 Shear, with their Lambs at foot.

1. The Duke of Argyll, K.G., Ballymenach, Campbeltown	10	0	0
2. James Macfarlane, Craignick, Lismore, Oban	5	0	0
3. R. & J. Cadzow, Borland, Biggar	2	0	0

V. H. C.—D. T. Martin of Girgenti, Irvine. H.C.—Lady John Scott, Flass Farm.

SECTION 5. Three SHEARLING EWES or GIMMERS.

1. R. & J. Cadzow, Borland, Biggar	10	0	0
2. The Duke of Argyll, K.G., Ballymenach, Campbeltown	5	0	0
3. D. T. Martin of Girgenti, Irvine	2	0	0

V. H. C.—The Duke of Argyll, K.G. H. C.—D. T. Martin of Girgenti. C.—Lady John Scott, Flass Farm.

CHEVIOT.

SECTION 6. TUP, above 1 Shear.

1. Jacob Robson, Byrness, Otterburn	12	0	0
2. John Robson, Newton, Bellingham	8	0	0
3. John A. Johnstone, Archbank, Moffat	4	0	0

V. H. C.—John A. Johnstone. H. C.—John Robson, Newton. C.—Jacob Robson, Byrness.

SECTION 7. SHEARLING TUP.

1. John Robson, Newton, Bellingham	12	0	0
2. John A. Johnstone, Archbank, Moffat	8	0	0
3. John Robson, Newton, Bellingham	4	0	0

V. H. C.—John Robson, Newton. H. C.—Elliot & Smith, Mowhaugh. C.—R. W. Laidlay, Halls.

SECTION 8. Three EWES, above 1 Shear, with their Lambs at foot.

1. Jacob Robson, Byrness, Otterburn	10	0	0
2. R. W. Laidlay, Halls, Dunbar	5	0	0
3. John Robson, Newton, Bellingham	2	0	0

V. H. C.—W. Connel Black, Kailzie. H. C.—R. W. Laidlay, Halls. C.—Jacob Robson, Byrness.

SECTION 9. Three SHEARLING EWES or GIMMERS.

1. R. W. Laidlay, Halls, Dunbar	10	0	0
2. Jacob Robson, Byrness, Otterburn	5	0	0
3. John Robson, Newton, Bellingham	2	0	0

V. H. C.—Jacob Robson. H. C.—R. W. Laidlay. C.—W. Connel Black, Kailzie, Peebles.

BORDER LEICESTER.

SECTION 10. TUP, above 1 Shear.

1. Robert Kay, Softlaw, Kelso	12	0	0
2. Trustees of R. Fender, Northfield, Coldingham	8	0	0
3. George Cowe, Balhousie, Carnoustie	4	0	0

V. H. C.—Right Hon. Arthur J. Balfour of Whittinghame, M.P. C.—George Simson, Courthill, Kelso.

SECTION 11. SHEARLING TUP.

1. Thomas Clark, Oldhamstocks Mains, Cockburnspath	12	0	0
2. Thomas Clark, Oldhamstocks Mains	8	0	0
3. Thomas Clark, Oldhamstocks Mains	4	0	0

V. H. C.—William Ford, Fenton Barns. H. C.—The Earl of Morton, Dalmahoy. James Nisbet, Lambden. C.—W. S. Ferguson, Pictstonhill. George Simson, Courthill.

Carry forward . . £236 0 0

Brought forward	£236	0	0

SECTION 12. Three EWES, above 1 Shear.

1. Right Hon. Arthur J. Balfour of Whittinghame, M.P.	10	0	0
2. Trustees of R. Fender, Northfield, Coldingham	5	0	0
3. George Robeson, Springwells, Coldstream	2	0	0

V. H. C.—George Simson, Courthill.

SECTION 13. Three SHEARLING EWES or GIMMERS.

1. Thomas Clark, Oldhamstocks Mains, Cockburnspath	10	0	0
2. The Earl of Morton, Dalmahoy, Kirknewton	5	0	0
3. Thomas Clark, Oldhamstocks Mains	2	0	0

V. H. C.—Right Hon. A. J. Balfour of Whittinghame, M.P. H. C.—George Simson, Courthill. C.—George Robeson, Springwells.

SHROPSHIRE.

SECTION 14. TUP, above 1 Shear.

1. David Buttar, Corston, Coupar-Angus	10	0	0
2. Thomas Newton, Helm Side, Oxenholme, Kendal	5	0	0
3. George P. Davidson, Banchory, Kirkcaldy	3	0	0

C.—Thomas Newton, Helm Side. John Wallace, Duniface, Leven.

SECTION 15. SHEARLING TUP.

1. David Buttar, Corston, Coupar-Angus	10	0	0
2. David Buttar, Corston, Coupar-Angus	5	0	0
3. The Earl of Strathmore, Glamis Castle, Glamis	3	0	0

V. H. C.—The Earl of Strathmore. H. C.—Lord Polwarth, Humbie. C.—Lord Polwarth.

SECTION 16. Three EWES, above 1 Shear.

1. A. J. S. Johnstone of Halleaths, Lockerbie	8	0	0
2. David Buttar, Corston, Coupar-Angus	4	0	0
3. The Earl of Strathmore, Glamis Castle, Glamis	2	0	0

C.—George P. Davidson, Banchory. Lord Polwarth, Humbie.

SECTION 17. Three SHEARLING EWES or GIMMERS.

1. David Buttar, Corston, Coupar-Angus	8	0	0
2. David Buttar, Corston, Coupar-Angus	4	0	0
3. John Wallace, Duniface, Leven	2	0	0

V. H. C.—The Earl of Strathmore. C.—A. J. S. Johnstone of Halleaths. Lord Polwarth, Humbie.

SHORT-WOOLLED OTHER THAN SHROPSHIRE.

SECTION 18. TUP, above 1 Shear.

1. John C. Toppin, Musgrave Hall, Skelton (Oxford Down)	3	0	0
2. The Right Hon. Arthur James Balfour of Whittinghame, M.P. (Oxford Down)	2	0	0

SECTION 19. SHEARLING TUP.

1. John C. Toppin, Musgrave Hall, Penrith (Oxford Down)	3	0	0
2. John C. Toppin, Musgrave Hall, Penrith (Oxford Down)	2	0	0

H. C.—Right Hon. Arthur James Balfour, M.P. (Oxford Down). C.—John Heskett, Plumpton Hall, Penrith (Oxford Down).

SECTION 20. Three EWES, above 1 Shear.

1. John C. Toppin, Musgrave Hall, Penrith	3	0	0
2. Right Hon. Arthur J. Balfour of Whittinghame, M.P.	2	0	0

H. C.—H. Middleton, Kimmerghame Mains, Duns.

SECTION 21. Three SHEARLING EWES or GIMMERS.

1. John C. Toppin, Musgrave Hall, Penrith	3	0	0
2. John Heskett, Plumpton Hall, Penrith	2	0	0

C.—Right Hon. Arthur J. Balfour, M.P.

Carry forward	£354	0	0

Brought forward	£354	0	0

HALF-BRED.

BEST TUP.—Given by breeders of Half-bred Sheep. Andrew T. Elliot, Newhall, Galashiels	10	10	0
BEST PEN OF EWES OR EWE LAMBS.—Given by Breeders of Half-Bred Sheep. R. W. Laidlay, Halls, Dunbar	10	10	0

SECTION 22. TUP, above 1 Shear.

1. Messrs Elliot, Harehead, Duns	10	0	0
2. Gideon Pott, Knowesouth, Jedburgh	5	0	0
3. Thomas Elliot, Blackhaugh, Galashiels	3	0	0

H. C.—Gideon Pott, Knowesouth, Jedburgh.

SECTION 23. SHEARLING TUP.

1. Andrew T. Elliot, Newhall, Galashiels	10	0	0
2. John Bertram, Addinston, Lauder	5	0	0
3. R. W. Laidlay, Halls, Dunbar	3	0	0

V. H. C.—Andrew T. Elliot. H. C.—Andrew T. Elliot. C.—Somner Logan, Harrietfield, Kelso.

SECTION 24. Three EWES, above 1 Shear.

1. R. W. Laidlay, Halls, Dunbar	8	0	0
2. James Laurence & Sons, Whytbank, Galashiels	4	0	0
3. R. W. Laidlay, Halls, Dunbar	2	0	0

V. H. C.—Thomas Elliot, Blackhaugh. H. C.—Gideon Pott, Knowesouth. C.—Gideon Pott.

SECTION 25. Three SHEARLING EWES or GIMMERS.

1. R. W. Laidlay, Halls, Dunbar	8	0	0
2. James Laurence & Sons, Whytbank, Galashiels	4	0	0
3. John Bertram, Addinston, Lauder	2	0	0

V. H. C.—John Riddell, The Rink. H. C.—R. W. Laidlay, Halls. C.—W. Connel Black, Kailzie, Peebles.

SECTION 26. Three EWE LAMBS. Given by Breeders of Half-Bred Sheep.

1. Andrew T. Elliot, Newhall, Galashiels	8	0	0
2. Andrew T. Elliot, Newhall, Galashiels	4	0	0
3. Gideon Pott, Knowesouth, Jedburgh	2	0	0

V. H. C.—James Laurence & Sons, Whytbank. H. C.—Robert Hall, Kilnknowe, Galashiels. C.—James Mein, Lamberton, Berwick.

SECTION 27. Three WETHERS, 1 Shear. Given by Breeders of Half-Bred Sheep.

1. William Tod, Pardovan, Philipstoun	8	0	0
2. William Tod, Pardovan, Philipstoun	4	0	0
3. Walter Elliot, Hollybush, Galashiels	2	0	0

V. H. C.—Lord Polwarth, Mertoun. H. C.—Lord Polwarth, Brotherstone. C.—Admiral Fairfax, Broomhill, Melrose.

EXTRA SECTION.

SECTION 28. Three BLACKFACED WETHERS, 1 Shear.

1. James M'Dougal, Lylestone, Lauder	4	0	0
2. John Gilmour of Montrave, Leven, Fife	2	0	0
3. John Gilmour of Montrave, Leven, Fife	1	0	0

V. H. C.—James Weir, Sandilands, Lanark.

HEAVIEST PEN OF THREE, 1 SHEAR, BLACKFACED WETHERS, entered in Section 28. Given by Mr Howatson of Glenbuck. The weights of the competing Pens to be published.

1. James Weir, Sandilands, Lanark—165, 169, and 157 lb. = 491 lb.	10	0	0
2. John Gilmour of Montrave, Leven, Fife—161, 161, and 158 lb. = 480 lb.	6	0	0
Carry forward	£490	0	0

Brought forward	£490	0	0
3. William Watt, Dura Mains, Cupar Fife—161, 153, and 162 lb. = 476 lb.	4	0	0
4. James M'Dougal, Lylestone, Lauder—161¼, 156½, and 145 lb. = 462¾ lb.	2	0	0

SECTION 29. Three CHEVIOT WETHERS, 1 Shear.

1. William Tod, Pardovan, Philipstoun	4	0	0
2. James Russel, Dundas Castle, South Queensferry	2	0	0
3. James Russel, Dundas Castle, South Queensferry	1	0	0

H. C.—Wm. Tod, Pardovan. C.—Walter Elliot, Hollybush, Galashiels.

SECTION 30. Three CROSS-BRED WETHERS, 1 Shear.

No entry.

WOOL.

BLACKFACED SHEEP (entered in any Class, Male or Female), carrying the fleece best adapted for protecting the animal in a high, exposed, and stormy climate. Animals must be drafted from the regular classes. Given by Mr Howatson of Glenbuck.

1. Alexander Clark, Todlaw, Lesmahagow	3	0	0
2. John Archibald, Overshiels, Stow	2	0	0
3. The Duke of Argyll, K.G., Ballymenach, Campbeltown	1	0	0

V. H. C.—D. T. Martin of Girgenti. H. C.—John Archibald.

EXTRA SHEEP.

Very Highly Commended.

Cross Wethers, 1 shear, John Gilmour of Montrave, Leven	Minor Gold Medal	3	6	0
Three parts Wethers, Lord Polwarth, Mertoun	Minor Gold Medal	3	6	0
		£515	12	0

CLASS IV.—SWINE.

SECTION 1. BOAR, Large Breed.

1. Sanders Spencer, Holywell Manor, St Ives, Hunts	£5	0	0
2. William Ramsden, Westfield House, Knotty Ash, Liverpool	3	0	0
3. Sanders Spencer, Holywell Manor, St Ives, Hunts	1	0	0

SECTION 2. SOW, Large Breed.

1. Sanders Spencer, Holywell Manor, St Ives, Hunts	4	0	0
2. Somner Logan, Harrietfield, Kelso	2	0	0
3. James Neill, Barleith, Hurlford, Kilmarnock	1	0	0

C.—William Ramsden, Westfield House.

SECTION 3. Three PIGS, Large Breed, not above 8 Months old.

1. Somner Logan, Harrietfield, Kelso	4	0	0
2. Sanders Spencer, Holywell Manor, St Ives, Hunts	2	0	0
3. William Ramsden, Westfield House, Knotty Ash	1	0	0

SECTION 4. BOAR, Black or Berkshire.

1. William Ramsden, Westfield House, Knotty Ash, Liverpool	5	0	0
2. Captain Clayhills Henderson, R.N., Invergowrie, Dundee	3	0	0
3. W. E. Gilmour, Woodbank, Alexandria, N.B.	1	0	0

SECTION 5. SOW, Black or Berkshire.

1. William Ramsden, Westfield House, Knotty Ash, Liverpool	4	0	0
2. Captain Clayhills Henderson, R.N., Invergowrie, Dundee	2	0	0
3. Henry Richly, Market Place, Corbridge-on-Tyne	1	0	0

V. H. C.—W. E. Gilmour, Woodbank, Alexandria, N.B.

Carry forward	£39	0	0

Brought forward	£39	0	0

SECTION 6. Three PIGS, Black or Berkshire, not above 8 Months old.

1. Lord Polwarth, Mertoun, St Boswells	4	0	0
2. Henry Richly, Market Place, Corbridge-on-Tyne	2	0	0

SECTION 7. BOAR, Middle White Breed.

1. William Ramsden, Westfield House, Knotty Ash	5	0	0
2. Robert Logan, Birkenside, Earlston	3	0	0
3. Sanders Spencer, Holywell Manor, St Ives, Hunts	1	0	0

V. H. C.—William Ramsden.

SECTION 8. SOW, Middle White Breed.

1. Robert Logan, Birkenside, Earlston	4	0	0
2. James Neill, Barleith, Hurlford, Kilmarnock	2	0	0
3. William Ramsden, Westfield House, Knotty Ash	1	0	0

V. H. C.—William Ramsden. C.—Sanders Spencer, Holywell Manor. Sanders Spencer.

SECTION 9. Three PIGS, not above 8 Months old.

1. Sanders Spencer, Holywell Manor, St Ives, Hunts	4	0	0
2. William Ramsden, Westfield House, Knotty Ash	2	0	0

EXTRA SWINE.

Very Highly Commended.

Boar, large breed. Somner Logan, Harrietfield, Kelso. (Winner of 1st Prize at Glasgow Show, 1888) . . . Minor Gold Medal	3	6	0
	£70	6	0

CLASS V.—POULTRY.

SECTION.

1. DORKING, Silver Grey. Cock—

1. W. Ovens of Torr, Castle Douglas	1	0	0
2. A. M'Ara, Culdees, Muthill	0	10	0

2. DORKING, Silver Grey. Hen—

1. W. Ovens of Torr, Castle Douglas	1	0	0
2. James Cranston, Tinwald House, Dumfries	0	10	0

3. DORKING, Silver Grey. Cockerel—

1. James Robertson, Home Farm, Gordon Castle, Fochabers	1	0	0
2. James Cranston, Tinwald House, Dumfries	0	10	0

4. DORKING, Silver Grey. Pullet—

1. James Robertson, Home Farm, Gordon Castle, Fochabers	1	0	0
2. James Cranston, Tinwald House, Dumfries	0	10	0

5. DORKING, Coloured. Cock—

1. John Gillies, Edington Mills, Chirnside	1	0	0
2. James Cranston, Tinwald House, Dumfries	0	10	0

6. DORKING, Coloured. Hen—

1. John Gillies, Edington Mills, Chirnside	1	0	0
2. James Cranston, Tinwald House, Dumfries	0	10	0

7. DORKING, Coloured. Cockerel—

1. James Cranston, Tinwald House, Dumfries	1	0	0
2. Robert Toplis, Glamis Hotel, Glamis	0	10	0

8. DORKING, Coloured. Pullet—

1. William Adam, Tynet Lodge, Port-Gordon	1	0	0
2. William Adam, Tynet Lodge, Port-Gordon	0	10	0
Carry forward	£12	0	0

Brought forward	£12	0	0
9. COCHIN-CHINA. Cock—			
1. Lord Polwarth, Humbie, Upper Keith, East Lothian	1	0	0
2. Robert F. Dudgeon, The Grange, Kirkcudbright	0	10	0
10. COCHIN-CHINA. Hen—			
1. Lord Polwarth, Humbie, Upper Keith, East Lothian	1	0	0
2. Robert F. Dudgeon, The Grange, Kirkcudbright	0	10	0
11. COCHIN-CHINA. Cockerel.—*No Entry.*			
12. COCHIN-CHINA. Pullet—			
2. Robert F. Dudgeon, The Grange, Kirkcudbright	0	10	0
13. BRAMAHPOOTRA. Cock—			
1. John Gillies, Edington Mills, Chirnside	1	0	0
2. James Lorimer, Sandridge Cottage, Monifieth	0	10	0
14. BRAMAHPOOTRA. Hen—			
1. Lady Griselda Ogilvy, Airlie Castle, Alyth	1	0	0
2. John Gillies, Edington Mills, Chirnside	0	10	0
15. BRAMAHPOOTRA. Cockerel—			
1. Mrs James Lorimer, 33 High Street, Dundee	1	0	0
2. William Brown, Westfield, Dunfermline	0	10	0
16. BRAMAHPOOTRA. Pullet—			
1. Lady Griselda Ogilvy, Airlie Castle, Alyth	1	0	0
2. Robert Lorimer, 118 Murraygate, Dundee	0	10	0
17. SPANISH. Cock—			
1. Mrs D. Mackenzie, Post-Office, Meigle	1	0	0
18. SPANISH. Hen—			
1. Mrs D. Mackenzie, Post-Office, Meigle	1	0	0
2. Mrs D. Mackenzie, Post-Office, Meigle	0	10	0
19. SPANISH. Cockerel.—*No Entry.*			
20. SPANISH. Pullet.—*No Entry.*			
21. SCOTCH GREY. Cock—			
1. James Young, Haghill Lodge, Parkhead, Glasgow	1	0	0
2. David Hastings, Ladybrow, Darvel	0	10	0
22. SCOTCH GREY. Hen—			
1. Alex. Mitchell, Myrtle Cottage, Falkirk	1	0	0
2. David Hastings, Ladybrow, Darvel	0	10	0
23. SCOTCH GREY. Cockerel—			
1. Alexander Mitchell, Myrtle Cottage, Falkirk	1	0	0
2. Wm. S. Mitchell, Castle Orchards, Airth, Larbert	0	10	0
24. SCOTCH GREY. Pullet—			
1. A. W. Henderson, Airthrey Mills, Bridge of Allan	1	0	0
2. Matthew Smith, Townhead Farm, Thornhill	0	10	0
25. HAMBURG. Cock—			
1. William S. Robertson, 3 Taymouth Pl., Broughty Ferry	1	0	0
2. W. & A. Davidson, Braedale, Lanark	0	10	0
26. HAMBURG. Hen—			
1. William Robertson, Ladybank Cottage, Monifieth	1	0	0
2. William S. Robertson, 3 Taymouth Pl., Broughty Ferry	0	10	0
27. HAMBURG. Cockerel—			
1. James Huntly, Edington Mills, Chirnside	1	0	0
2. William Robertson, Ladybank Cottage, Monifieth	0	10	0
28. HAMBURG. Pullet—			
1. James Huntly, Edington Mills, Chirnside	1	0	0
29. Any other Pure Breed. Cock—			
1. David Hastings, Ladybrow, Darvel (Creve Cœur)	1	0	0
2. Wm. Cowan, 89 Highbuckholmside, Galashiels	0	10	0
30. Any other Pure Breed. Hen—			
1. David Hastings, Ladybrow, Darvel (Creve Cœur)	1	0	0
2. Rev. Fitzroy Lloyd, The Priory, Pittenweem	0	10	0
Carry forward	£38	10	0

	Brought forward	£38	10	0
31.	Any other Pure Breed. Cockerel—			
	1. Rev. Fitzroy Lloyd, The Priory, Pittenweem	1	0	0
	2. Mrs Kinnaird, Clockmill, Duns (Minorca)	0	10	0
32.	Any other Pure Breed. Pullet—			
	1. John Delvin, Cemetery Road, Dunfermline	1	0	0
	2. Rev. Fitzroy Lloyd, The Priory, Pittenweem	0	10	0
33.	GAME—Black or Brown Reds. Cock—			
	1. J. A. Mather, Eccles House, Thornhill	1	0	0
	2. R. G. Smith, Georgeville, Mid-Calder	0	10	0
34.	GAME—Black or Brown Reds. Hen—			
	1. J. & C. Sneddon, Beechbank, Ratho	1	0	0
	2. J. A. Mather, Eccles House, Thornhill	0	10	0
35.	GAME—Black or Brown Reds. Cockerel—			
	1. J. & C. Sneddon, Beechbank, Ratho	1	0	0
36.	GAME—Black or Brown Reds. Pullet—			
	1. R. G. Smith, Georgeville, Mid-Calder	1	0	0
	2. J. & C. Sneddon, Beechbank, Ratho, Mid-Lothian	0	10	0
37.	GAME—Any other Pure Breed. Cock—			
	1. J. A. Mather, Eccles House, Thornhill (Pile)	1	0	0
	2. J. & C. Sneddon, Beechbank, Ratho	0	10	0
38.	GAME—Any other Pure Breed. Hen—			
	1. J. A. Mather, Eccles House, Thornhill (Pile)	1	0	0
	2. J. & C. Sneddon, Beechbank, Ratho	0	10	0
39.	GAME—Any other Pure Breed. Cockerel—			
	1. J. & C. Sneddon, Beechbank, Ratho	1	0	0
	2. R. G. Smith, Georgeville, Mid-Calder (Pile)	0	10	0
40.	GAME—Any other Pure Breed. Pullet—			
	1. John Ellis, Water Head, Eddleston (Pile)	1	0	0
	2. J. & C. Sneddon, Beechbank, Ratho	0	10	0
41.	BANTAM—Any Pure Breed. Cock—			
	1. Mrs Frew, Sinclairton, Kirkcaldy	1	0	0
	2. J. & C. Sneddon, Beechbank, Ratho	0	10	0
42.	BANTAM—Any Pure Breed. Hen—			
	1. Miss Robina Frew, Sinclairton, Kirkcaldy	1	0	0
	2. J. & C. Sneddon, Beechbank, Ratho	0	10	0
43.	BANTAM—Any Pure Breed. Cockerel—			
	1. J. & C. Sneddon, Beechbank, Ratho	1	0	0
	2. Miss Bessie P. Frew, Sinclairton, Kirkcaldy	0	10	0
44.	BANTAM—Any Pure Breed. Pullet—			
	1. J. & C. Sneddon, Beechbank, Ratho	1	0	0
	2. John Roxburgh, Hoggbridge, Peebles (Black Red)	0	10	0
45.	DUCKS—White Aylesbury. Drake—			
	1. R. G. Smith, Georgeville, Mid-Calder	1	0	0
	2. R. F. Dudgeon, The Grange, Kirkcudbright	0	10	0
46.	DUCKS—White Aylesbury. Duck—			
	1. R. G. Smith, Georgeville, Mid-Calder	1	0	0
	2. R. G. Smith, Georgeville, Mid-Calder	0	10	0
47.	DUCKS—White Aylesbury. Drake (Young)—			
	1. R. G. Smith, Georgeville, Mid-Calder	1	0	0
	2. R. F. Dudgeon, The Grange, Kirkcudbright	0	10	0
48.	DUCKS—White Aylesbury. Duckling—			
	1. R. G. Smith, Georgeville, Mid-Calder	1	0	0
	2. R. G. Smith, Georgeville, Mid-Calder	0	10	0
49.	DUCKS—Rouen. Drake—			
	1. David L. Picken, Milton, Kirkcudbright	1	0	0
	2. R. G. Smith, Georgeville, Mid-Calder	0	10	0
50.	DUCKS—Rouen. Duck—			
	1. R. G. Smith, Georgeville, Mid-Calder	1	0	0
	2. R. G. Smith, Georgeville, Mid-Calder	0	10	0
	Carry forward	£68	0	0

	Brought forward . .	£68	0	0
51.	DUCKS—Rouen. Drake (Young)—			
	1. D. L. Picken, Milton, Kirkcudbright . . .	1	0	0
	2. R. G. Smith, Georgeville, Mid-Calder . . .	0	10	0
52.	DUCKS—Rouen. Duckling—			
	1. R. G. Smith, Georgeville, Mid-Calder . . .	1	0	0
	2. Alexander Hamilton, Braidwood Tile Works, Carluke .	0	10	0
53.	DUCKS—Any other Pure Breed. Drake—			
	1. Mrs Somner Logan, Harrietfield, Kelso (Pekin) . .	1	0	0
	2. R. G. Smith, Georgeville, Mid-Calder (Pekin) . .	0	10	0
54.	DUCKS—Any other Pure Breed. Duck—			
	1. Mrs Somner Logan, Harrietfield, Kelso (Pekin) . .	1	0	0
	2. R. G. Smith, Georgeville, Mid-Calder (Pekin) . .	0	10	0
55.	DUCKS—Any other Pure Breed. Drake (Young)—			
	1. Mrs Logan, Birkenside, Earlston (Pekin) . . .	1	0	0
	2. R. G. Smith, Georgeville, Mid-Calder (Pekin) . .	0	10	0
56.	DUCKS—Any other Pure Breed. Duckling—			
	1. George L. Oliver, Whithaugh, Newcastleton . .	1	0	0
	2. R. G. Smith, Georgeville, Mid-Calder (Pekin) . .	0	10	0
57.	TURKEYS—Any Pure Breed. Cock—			
	1. John M. Martin of Auchendennan, Balloch . .	1	0	0
	2. R. G. Smith, Georgeville, Mid-Calder (Cambridge) .	0	10	0
58.	TURKEYS—Any Pure Breed. Hen—			
	1. John M. Martin of Auchendennan, Balloch . .	1	0	0
	2. Lord Polwarth, Humbie, Upper Keith . . .	0	10	0
59.	TURKEYS—Any Pure Breed. Cock (Poult)—			
	1. Abram Kerr, Castlehill, Thornhill (Bronze) . .	1	0	0
	2. R. G. Smith, Georgeville, Mid-Calder (Cambridge) .	0	10	0
60.	TURKEYS—Any Pure Breed. Hen (Poult)—			
	1. Abram Kerr, Castlehill, Thornhill (Bronze) . .	1	0	0
61.	GEESE—Any Pure Breed. Gander—			
	1. David L. Picken, Milton, Kirkcudbright (Toulouse) .	1	0	0
	2. R. G. Smith, Georgeville, Mid-Calder (Toulouse) .	0	10	0
62.	GEESE—Any Pure Breed. Goose—			
	1. John M. Martin of Auchendennan (Grey Toulouse) .	1	0	0
	2. David L. Picken, Milton, Kirkcudbright (Embden) .	0	10	0
63.	GEESE—Any Pure Breed. Gander (Young)—			
	1. R. G. Smith, Georgeville, Mid-Calder (Toulouse) .	1	0	0
	2. John M. Martin of Auchendennan (Grey Toulouse) .	0	10	0
64.	GEESE—Any Pure Breed. Gosling—			
	1. R. G. Smith, Georgeville, Mid-Calder (Toulouse) .	1	0	0
	2. David L. Picken, Milton, Kirkcudbright (Toulouse) .	0	10	0
		£88	10	0

CLASS VI.—DAIRY PRODUCE.

SECTION.				
1.	CURED BUTTER, not less than 28 lb.—			
	1. Henry Orr, Torrance, Armadale, West Lothian . .	£5	0	0
	2. Donald M'Farlane, Balmuldy, Maryhill . . .	4	0	0
	3. David Longwill, Kendieshill, Linlithgow . . .	3	0	0
	C.—Alexander Fleming, Threepland, Eaglesham.			
2.	POWDERED BUTTER, not less than 7 lb.—			
	1. Henry Orr, Torrance, Armadale, West Lothian . .	5	0	0
	2. Alexander Fleming, Threepland, Eaglesham . .	4	0	0
	3. Robert Gilmour, Stonebyres, Eaglesham . . .	3	0	0
	V. H. C.—Thomas Scott, Newlands, Bothwell. C.—David Longwill, Kendieshill, Linlithgow.			
	Carry forward . .	£24	0	0

	£	s.	d.
Brought forward .	£24	0	0
3. FRESH BUTTER, Three 1-lb. Rolls—			
1. Henry Orr, Torrance, Armadale, West Lothian . .	5	0	0
2. David Longwill, Kendieshill, Linlithgow . . .	4	0	0
3. Robert Gilmour, Stonebyres, Eaglesham . . .	3	0	0
V. H. C.—Thomas Scott, Newlands, Bothwell. C.—Donald M'Farlane, Balmuldy, Maryhill.			
4. Two SWEET-MILK CHEESES, not less than 30 lb., made according to any method—			
1. John MacCaig, Challoch, Leswalt, Stranraer . .	10	0	0
2. William M'Master, Challoch, Dunragit . . .	5	0	0
3. George Kennedy, Aird Dairy, Stranraer . . .	3	0	0
V. H. C.—Robert Montgomerie, Lessnessock. H. C.—James M'Master, Currochtree. C. — John Howie, Boghead, Craigie.			
	£54	0	0

CLASS VII.—IMPLEMENTS.

	£	s.	d.
John Turnbull & Son, Carnock, Larbert, for Hay and Straw Trusses .	£10	0	0

CLASS VIII.—HIGHLAND INDUSTRIES.

	£	s.	d.
P. & J. Haggart, Aberfeldy—Home-made Articles from Cheviot Wool .	£5	0	0
P. & J. Haggart, Aberfeldy—Home-made Articles from Blackfaced Wool	2	0	0
A. & J. M'Naughton, Pitlochry—Home-made Articles from Blackfaced Wool	5	0	0
A. & J. M'Naughton, Pitlochry — Home-made Articles from Cheviot Wool	2	0	0
	£14	0	0

ABSTRACT OF PREMIUMS.

	£	s.	d.
Cattle	£849	1	8
Horses	538	12	0
Sheep	515	12	0
Swine	70	6	0
Poultry	88	10	0
Dairy Produce	54	0	0
Implements	10	0	0
Highland Industries	14	0	0
	£2140	1	8

JUDGES.

SHORTHORN.—R. Stratton, The Duffyn, Newport, Mon.

AYRSHIRE.—John Murray, jun., Carston, Ochiltree.

ABERDEEN-ANGUS.—George J. Walker, Portlethen, Aberdeen; George Wilken, Waterside of Forbes, Alford, N.B.

GALLOWAY.—Robert Shennan, Balig, Kirkcudbright.

HIGHLAND.—Duncan M'Diarmid, Camusericht, Rannoch, Perthshire.

STALLIONS AND ENTIRE COLTS.—George Bean, Balquhain Mains, Pitcaple; James Kilpatrick, Craigie Mains, Kilmarnock; Robert Renwick, Dalmuir Farm, Dalmuir.

MARES AND FILLIES.—John Morrison, jun., Hattonslap, Old Meldrum; James F. Murdoch, East Hallside, Newton; Archibald Yuill, Netherside, Strathaven.

HUNTERS, ROADSTERS, AND PONIES.—A. Johnstone Douglas, Comlongan Castle, Ruthwell, N.B.; T. H. Hutchinson, The Manor House, Catterick, Yorkshire.

BLACKFACED. — Robert Buchanan, Parkhouse, Killearn; John Craig, South Halls, Strathaven; James Moffat, jun., Gateside, Sanquhar.

CHEVIOT.—John Elliot, Hindhope, Jedburgh; W. Mitchell, Ribigill, Tongue, Sutherland; Fras. Paterson, Clerkhill, Langholm.

BORDER LEICESTER.—William Bain, Legars, Kelso; James Deans, Dalkeith Park, Dalkeith; Andrew Smith, Longniddry.

SHROPSHIRE AND OTHER SHORT-WOOLLED.—Joseph Beach, The Hattons, Wolverhampton.

HALF-BRED.—William Ballantyne, Wormiston, Eddleston; George Douglas, Upper Hindhope, Jedburgh; Walter Scott, Mervinslaw, Jedburgh.

SWINE.—T. D. Findlay, Easterhill, Glasgow.

POULTRY.—James Dixon, North Park, Clayton, Bradford.

DAIRY PRODUCE.—Thomas Stevenson, 74 High Street, Johnstone.

ATTENDING MEMBERS.

SHORTHORN.—Sir James H. Gibson-Craig of Riccarton, Bart.; General Henry, C.B., The Pavilion; Thomas Elliot, Blackhaugh.

AYRSHIRE.—James M'Queen of Crofts, Dalbeattie; John Lorne Stewart of Coll; John Riddell of The Rink.

ABERDEEN-ANGUS.—Duncan Forbes of Culloden; W. E. O. Rutherfurd of Edgerston; Hilton Middleton, Kimmerghame Mains.

GALLOWAY.—Donald Fisher, Jellyholm; T. Anderson of Ettrick Shaws; James Dodd, Hundale Cottage.

HIGHLAND.—Sir Robert Menzies of Menzies; John S. Brunton of Hilton's Hill.

STALLIONS AND ENTIRE COLTS.—Andrew Allan, Munnoch, Dalry, Aryshire; Gideon Pott, Knowesouth; Robert Watson, Eccles, Newton.

MARES, FILLIES, AND GELDINGS.—Alexander Murdoch, Gartcraig, Shettleston; Robert Noble of Borthwickbrae; John Wilson, Chapelhill.

HUNTERS, ROADSTERS, AND PONIES.—R. F. Dudgeon, yr. of Cargen; R. J. Lang, yr. of Broadmeadows; Thomas Usher, Courthill.

BLACKFACED.—James Hewetson, Auchenbainzie; John Borthwick of Crookston; George M'Dougall of Earlston Mains.

CHEVIOT.—Walter Elliot, Hollybush; Captain Hope of Cowdenknowes; Thomas Gibson, Torwoodlee.

BORDER LEICESTER AND OTHER LONG-WOOLLED.—William Ford, Fentonbarns; The Master of Polwarth; W. L. Blaikie, Holydean.

SHROPSHIRE AND SHORT-WOOLLED.—John Ballingall, Dunbog; John S. Mack of Hillend; John Elliot, Meigle.

HALF-BRED.—R. Shirra Gibb, Boon; Robert Haldane of Shaw; John V. Lindsay, Whitehope.

SWINE.—David Buchanan, Garscadden Mains; John C. Scott of Synton; William Davidson, Colmslie.

POULTRY.—J. T. S. Paterson, Plean Farm; Edward P. Tennant, yr. of The Glen.

DAIRY PRODUCE.—C. H. Scott Plummer of Sunderland Hall; Robert Cunningham, Glendouglas; J. T. Fairbairn, Greenend.

III.—DISTRICT COMPETITIONS.

CATTLE, HORSES, AND SHEEP.

NAME OF DIST.	PREMIUM AWARDED TO	FOR	AMOUNT.
Gargunnock	M. C. Stark, Westerton	Ayrshire Cow	£3 0 0
	James Strang, Knockinshannoch	Ayrshire Bull	3 0 0
	R. C. M'Farlane, West Carse	Clydesdale Mare	3 0 0
	James Sands, Greenfoot	Clydesdale Mare	3 0 0
Sutherland	Alex. Cameron, Drummine	Draught Mare	1 0 0
	Ewen M. Sutherland, Pulrossie	Draught Mare	1 0 0
	Alexander Grant, Evelix	Two-year-old Filly	1 0 0
	John Mackintosh, Proncy	One-year-old Filly	1 0 0
	Hugh Ross, Inverbrora	Shorthorn Bull	1 0 0
	Duke of Sutherland, K.G.	Yearling Shorthorn Bull	1 0 0
	Duke of Sutherland, K.G.	Aberdeen-Angus Bull	1 0 0
	Duke of Sutherland, K.G.	Aberdeen-Angus Cow	1 0 0
	J. B. Dudgeon, Crakaig	Aged Cheviot Tup	1 0 0
	J. B. Dudgeon, Crakaig	Shearling Cheviot Tup	1 0 0
	J. B. Dudgeon, Crakaig	Cheviot Ewes	1 0 0
	J. B. Dudgeon, Crakaig	Cheviot Gimmers	1 0 0
Stranraer and Rhins of Galloway	John Chalmers, Freugh	Ayrshire Bull	3 0 0
	Wm. Murray, Barrowmoss	Ayrshire Cow	3 0 0
	Mathew Marshall, Stranraer	Clydesdale Stallion	3 0 0
	Alex. Black, Craigencross	Clydesdale Mare	3 0 0
Garioch	James Merson, Craigwillie	Shorthorn Bull	Minor Silver Medal
	Captain Edward Fraser of Williamston	Aberdeen-Angus Bull	Minor Silver Medal
	George Innes, Whitehouse	Aberdeen-Angus Cow	Minor Silver Medal
Dalbeattie	James Cunningham, Tarbreoch	Galloway Bull	Minor Silver Medal
	James Cunningham, Tarbreoch	Galloway Cow	Minor Silver Medal
	Thomas Biggar & Sons, Chapelton	Galloway Heifer	Minor Silver Medal
Deeside Union	Chas. Robertson, Sunhoney	Shorthorn Bull	Minor Silver Medal
	George Hamilton of Skene House	Aberdeen-Angus Bull	Minor Silver Medal
	George Hunter, New Banchory	Aberdeen-Angus Heifer	Minor Silver Medal
Turriff	William Norrie, Cairnhill	Shorthorn Bull	Minor Silver Medal
	Alex. Simpson, Kirkside	Aberdeen-Angus Bull	Minor Silver Medal
	George Bean, Balquhain	Clydesdale Filly	Minor Silver Medal

Carry forward £36 0 0

NAME OF DIST.	PREMIUM AWARDED TO	FOR	AMOUNT.
		Brought forward	£36 0 0
Lammermoor	James Mien, Lamberton	Half-bred Ewe Lambs	Minor Silver Medal
	James Logan, Burnhouses	Cheviot Gimmers	Minor Silver Medal
	Lady John Scott, Flass	Blackfaced Ewe Lambs	Minor Silver Medal
Biggar	Alex. Williamson, Chesterhall	Clydesdale Mare	Minor Silver Medal
	Alex. Williamson, Chesterhall	Two-year-old Filly	Minor Silver Medal
	Thomas Clark, Thriepland	Three-year-old Filly	Minor Silver Medal
Breadalbane	John Fisher, Auchrioch	Aged Blackfaced Tup	Minor Silver Medal
	John Willison, Acharn	Shearling Blackfaced Tup	Minor Silver Medal
	Marquis of Breadalbane	Blackfaced Gimmers	Minor Silver Medal
Eastern District of Stirlingshire	James Shanks, Headswood	Ayrshire Bull	Minor Silver Medal
	A. H. Boyle of Banknock	Clydesdale Mare	Minor Silver Medal
	Alex. Simpson, West Mains	Entire Colt	Minor Silver Medal
Elgin, &c.	John Marr, Cairnbrogie	Stallion	15 0 0
Lanark	Wm. Renwick, Meadowfield	Stallion	15 0 0
Selkirk and Galashiels	Alexander Scott, Greenock	Stallion	15 0 0
Royal Northern	W. J. Mathieson, Newton	Aged Shorthorn Bull	Minor Silver Medal
	R. Turner, Cairnton	Two-year-old Shorthorn Bull	Minor Silver Medal
	Jas. M'William, Stoneyton	Shorthorn Heifer	Minor Silver Medal
Strathbogie	Alex. Simpson, Kirkside	Aged Aberdeen-Angus Bull	Minor Silver Medal
	William Wilson, Coynachie	Two-year-old Aberdeen-Angus Bull	Minor Silver Medal
	Geo. Cruickshank, Netherton	Shorthorn Heifer	Minor Silver Medal
United Banffshire	Alex. Simpson, Kirkside	Aged Aberdeen-Angus Bull	Minor Silver Medal
	Robert Turner, Cairnton	Two-year-old Shorthorn Bull	Minor Silver Medal
	Countess Dowager of Seafield	Aberdeen-Angus Heifer	Minor Silver Medal
Inverness	Earl Cawdor	Brood Mare	4 0 0
	W. C. Ross of Cromarty	do.	3 0 0
		Carry forward	£88 0 0

NAME OF DIST.	PREMIUM AWARDED TO	FOR	AMOUNT.
		Brought forward .	£88 0 0
Kinross-shire	James Steedman of Fruix	Brood Mare	4 0 0
	Wm. Tod of East Brackley	do.	3 0 0
Dumbarton-shire	Jn. Macdonald, Boquhanran	Two-year-old Colt . . .	2 0 0
	Jn. Macdonald, Boquhanran	do. . . .	1 0 0
	Wm. Houston, Whiteleys	One-year-old Colt . . .	2 0 0
	Jn. Macdonald, Boquhanran	do. . . .	1 0 0
	Robert Renwick, Dalmuir	Two-year-old Filly . .	2 0 0
	Miss Govan, Mains Farm	do. . . .	1 0 0
	Hugh Allison, Duntiglennan	do. . . .	0 10 0
	Robert Renwick, Dalmuir	One-year-old Filly . .	2 0 0
	Samuel Hutchison, Meikle Blairlusk	do. . . .	1 0 0
	J. & A. Douglas, Braes o' Yetts	do. . . .	0 10 0
Lower District of Wigtown-shire	Wm. M'Connell, Glasnick	Two-year-old Colt . . .	2 0 0
	A. & W. Hunter, Causewayend	do. . . .	1 0 0
	Jas. A. Wallace, Clay Crop	One-year-old Colt . . .	2 0 0
	James M'Connell, Boreland	do. . . .	1 0 0
	John Morton, Auldbreck	Two-year-old Filly . .	2 0 0
	A. B. Matthews, Newton Stewart	do. . . .	1 0 0
	James M'Harg, Barbuchany	do. . . .	0 10 0
	William Callander, Barr	One-year-old Filly . .	2 0 0
	A. B. Matthews, Newton Stewart	do. . . .	1 0 0
	William M'Michael, Barholm Mains	do. . . .	0 10 0
West Teviot-dale	S. Clark, Chapelhill	Aged Cheviot Tup . . .	2 0 0
	Miss Grieve, Skelfhill	do. . .	1 0 0
	Miss Grieve, Skelfhill	Shearling Cheviot Tup . .	2 0 0
	John Scott, West Deloraine	do. . .	1 0 0
	Scott & Douglas, Edgerstone Tofts	Cheviot Ewes	1 0 0*
	Miss Grieve, Skelfhill	do. . . .	0 10 0*
	John Scott, West Deloraine	Cheviot Gimmers . . .	2 0 0
	Scott & Douglas, Edgerstone Tofts	do. . . .	1 0 0
Arran	James Allan, jun., Balnacoole	Aged Blackfaced Tup	Minor Silver Medal
	James Allan, jun., Balnacoole	Shearling Blackfaced Tup	Minor Silver Medal
	James Allan, jun., Balnacoole	Blackfaced Ewes	Minor Silver Medal
	James Allan, jun., Balnacoole	Blackfaced Gimmers	Minor Silver Medal
			£131 10 0
		37 Minor Silver Medals	9 11 2
			£141 1 2

SPECIAL GRANTS.

Ayrshire Agricultural Association	Vote to Dairy Produce Show at Kilmarnock	£20 0 0
Orkney Agricultural Society	Vote in aid of Premiums . .	3 0 0
Rousay Agricultural Society	Vote in aid of Premiums . .	3 0 0
		£26 0 0

* Half Premiums awarded, the number of lots exhibited being under five.

MEDALS IN AID OF PREMIUMS GIVEN BY LOCAL SOCIETIES.

Minor Silver Medals were awarded to the following:—

NAME OF DIST.	SILVER MEDAL AWARDED TO	FOR
	ABERDEENSHIRE.	
Kennethmont	Colonel Leith Hay, Leithhall	Shorthorn Cow
	Major Gordon, Culdrain	Draught Filly
Monquhitter	William Norrie, Cairnhill	Shorthorn Bull
	James Fowlie, Brucehill	Aberdeen-Angus Bull
	Gavin Catto, Lendrum	Draught Filly
	James Fowlie, Brucehill	One-year-old Colt
New Aberdour	James Watson, Brunthill	Collection of Seeds
	Alexander Chapman, Bonnytounhill	Collection of Roots
	George Bruce, Pennan Farm	Shorthorn Cow
	George Watson, Middlemuir	Draught Gelding
	James Chessor, Craigiebank	Shropshire Tup
Slains	James Cochrane, Waterside	Shorthorn Ox
	James Cochrane, Waterside	Clydesdale Gelding
Vale of Alford	R. F. O. Farquharson of Haughton	Swedish Turnips
	William Yool, Glenlogie	Yellow Turnips
	AYRSHIRE.	
Ardrossan	James Caldwell, Blackshaw	Ayrshire Cow
	James Greig, Goldenberry	Entire Colt
Colmonell and Ballantrae	James Brisbane, Polcardoch	Ayrshire Cow
	R. & D. Wright, Downan	Draught Filly
	John Semple, Balkissock	Blackfaced Shearling Tup
Cumnock	James Murray, Muir	Ayrshire Cow
	James Robb, Hindsward	Brood Mare
Dalrymple	James Kay, Sauchrie	Ayrshire Cow
	James Armstrong, Thornhill	Draught Mare
Darvel	James Bulger, Darvel	Collection of Roots
	John Cameron, Loudounhill	Sweet-milk Cheese
	John Cleland, Darvel	Collection of Flowers
	John Steel, High Newton	Powdered Butter
Girvan	James Wilson, Macherquhat	Ayrshire Heifer
	Thomas Crawford, Drumbeg	Clydesdale Mare
Irvine	Hugh Todd, Harperland	Ayrshire Cow
	John Todd, Old Rome	Clydesdale Mare
Monkton, Newton, &c.	Jas. A. Reid, Mid-Sanquhar	Ayrshire Cow
	Trustees of late R. F. F. Campbell	Clydesdale Filly
Patna	Miss Mair, Shallock	Ayrshire Heifer
	A. Logan, Overton	Clydesdale Filly
	James M'Minn, Meiklehill	Blackfaced Ewes
West Kilbride	Mrs Arthur, Carlung	Ayrshire Bull
	Mrs Arthur, Carlung	Clydesdale Mare
	DUMBARTONSHIRE.	
Cumbernauld	Alex. Weir, Smithstone	Ayrshire Cow
	Alex. Weir, Smithstone	Ayrshire Bull
	Thomas Chalmers, Walton	Clydesdale Mare
	EDINBURGHSHIRE.	
Dalkeith	William Park, Brunstane	Clydesdale Filly
	Robert Andrew, Smeaton	Clydesdale Colt
	Robt. White, Outerston	Mare for road or field
	Mrs Inglis, Brothershiels	Half-bred Ewe Lambs
	INVERNESS-SHIRE.	
Highland Poultry and Pigeon	John Cran, Keith	Poultry
	William Ferguson, Inverness	Poultry
Strathglass	Lord Tweedmouth	Sandy Oats
	Lord Tweedmouth	Potatoes

NAME OF DIST.	SILVER MEDAL AWARDED TO	FOR
	KINCARDINESHIRE.	
Fettercairn	Sir John Gladstone of Fasque, Bart.	Aberdeen-Angus Bull
	John Smith, Balmain	Shorthorn Bull
	Kincardineshire Land Farming Co.	Brood Mare
	NAIRNSHIRE.	
Nairnshire Ornithological	Joseph Shirlay, Kinsteary	Dorkings
	William M'Ulloch, Dalziel	Brahmas
	William M'Ulloch, Dalziel	Spanish
	William Stephen, Nairn	Hamburgs
	ORKNEY.	
Rousay	General Burroughs of Rousay, C.B.	Shorthorn Bull
	John Gibson, Langskail	Clydesdale Mare
	PERTHSHIRE.	
Mid. Dist. of Athole and Tullymet	James Borrie, Mains of Kilmorich	Green Crop
	John M'Donald, Countlich	Green Crop
Moulin	William Maxwell of Donavourd	Green Crop
	RENFREWSHIRE.	
Mearns	Mrs Smith, Greenlaw	Ayrshire Bull
	William Clark, Cleugh	Clydesdale Mare
	ROSS-SHIRE.	
Northern Pastoral	Walter Mundell, Moy	Aged Cheviot Tup
	Walter Mundell, Moy	Shearling Cheviot Tup
Wester Ross	Murdo & Evan Macrae, Kinbeachie	Highland Cow

67 Minor Silver Medals, £17, 6s. 2d.

PLOUGHING COMPETITIONS.

In 1888-89 the Society's Silver Medal was awarded at 158 Ploughing Competitions.

158 Minor Silver Medals, £40, 16s. 4d.

IV.—COTTAGES AND GARDENS.

Money Premiums	£9	0	0
34 Minor Silver Medals	8	15	8
Total	£17	15	8

V.—VETERINARY DEPARTMENT.

CLASS EXAMINATIONS—APRIL 1889.

ROYAL (DICK) VETERINARY COLLEGE.

John C. Rowlands	Cattle Pathology	W. M. Pye	Junior Anatomy
Arnold Richardson	Horse Pathology	Arthur Breakall	Physiology
A. E. Mettam	Practical Pathology	John Davidson	Chemistry
R. G. Robertson	Senior Anatomy	James Henderson	Botany

NEW VETERINARY COLLEGE, EDINBURGH.

J. Robertson	Cattle, &c., Pathology	J. H. Parker	Physiology
F. Booth	Horse Pathology	J. Connochie	Chemistry
J. H. Parker	Anatomy	J. Connochie	Botany
R. E. Johnston	Junior Anatomy		

GLASGOW VETERINARY COLLEGE.

David Warnock	Cattle Pathology	J. A. Trotter	Histology & Physiology
James Gregg	Horse Pathology		
J. K. Bruce	Anatomy	James Forrest	Chemistry
J. A. Gilruth	Junior Anatomy	J. A. Gilruth	Botany

22 Large Silver Medals, £15, 8s.

VI.—AGRICULTURAL CLASS, EDINBURGH UNIVERSITY.

1.	John Bayne, Millhill, Braco, Perthshire	£6	0	0
2.	Thomas Askew Coward, Carlisle	4	0	0
		£10	0	0

ABSTRACT OF PREMIUMS.

1. ESSAYS AND REPORTS,				£55	0	0
2. MELROSE SHOW, 1889,				2140	1	8
3. DISTRICT SHOWS:—						
Stock	£141	1	2			
Special Grants	26	0	0			
Local Societies—67 Medals	17	6	2			
Ploughing Associations—158 Medals	40	16	4			
				225	3	8
4. COTTAGES AND GARDENS—Money Premiums, £9; 34 Minor Silver Medals, £8, 15s. 8d.				17	15	8
5. VETERINARY DEPARTMENT—Medals to Students				15	8	0
6. AGRICULTURAL CLASS, EDINBURGH UNIVERSITY				10	0	0
				£2463	9	0

STATE OF THE FUNDS
OF
THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

At 30th NOVEMBER 1889.

I. BONDS—		
Heritable £1,300 at 4 per cent, £4,000 at 3¾ per cent, £11,479, 16s. at 3½ per cent,		£16,779 16 0
Debenture Bonds by Clyde Navigation Trustees at 4 per cent,		2,000 0 0
		£18,779 16 0
II. DEBENTURE STOCK—		
£3,000 North British Railway Company 4¼ per cent, at £132, 5s.,	£3,967 10 0	
£2,727 Caledonian Railway Company 4 per cent, at £129, 5s.,	3,524 13 0	
£1,000 London and North-Western Railway Company 4 per cent, at £133,	1,330 0 0	
		8,822 3 0
III. BANK STOCKS—		
£6,407, 7s. 8d. Royal Bank of Scotland, at £222,	£14,224 7 10	
£2,218, 6s. 5d. Bank of England at £333, 10s.	7,398 2 0	
£2,000, 0s. 0d. British Linen Company Bank, at £343,	6,860 0 0	
£1,250, 0s. 0d. National Bank of Scotland, at £316,	3,950 0 0	
£1,080, 0s. 0d. Commercial Bank of Scotland, at £60, 10s. per share of £20, or at £302, 10s. per £100,	3,267 0 0	
£1,091, 13s. 4d. Bank of Scotland at £313,	3,416 18 4	
£14,047, 7s. 5d.		£39,116 8 2

Note.—The original cost of these Bank Shares was £22,360, 19s. 6d., showing a profit, at present prices, of £16,755, 8s. 8d.

IV. TEN SHARES (£500) OF THE BRITISH FISHERIES' SOCIETY, valued at	200 0 0
V. ARREARS OF MEMBERS' SUBSCRIPTIONS, considered recoverable,	48 4 6
	£66,966 11 8
Deduct.—BALANCE DUE TO ROYAL BANK OF SCOTLAND ON ACCOUNT CURRENT, at 30th November 1889,	754 0 0
AMOUNT OF GENERAL FUNDS,	£66,212 11 8
VI. BUILDING FUND—	
1. Estimated value of Building, No. 3 George IV. Bridge,	£3,100 0 0
2. Sum lent on Heritable Bond, at 3½ per cent,	350 0 0
3. Deposit with Royal Bank of Scotland,	89 3 8
AMOUNT OF BUILDING FUND,	£3,539 3 8
VII. TWEEDDALE MEDAL FUND—	
Heritable Bond, at 3¾ per cent,	£500 0 0
VIII. FURNITURE—	
Estimated Value of Furniture, Paintings, Books, &c.,	£1,000 0 0

W. S. WALKER, *Treasurer.*
JAS. AULDJO JAMIESON, *Chairman of Finance Committee.*
WM. HOME COOK, C.A., *Auditor.*

EDINBURGH, *7th January* 1890.

VIEW OF THE INCOME AND EXPENDITURE

For the Year 1888-89.

INCOME.

1. Annual Subscriptions and Arrears received, ...		£727 2 6
2. Life Subscriptions received, ...		788 19 0
		£1,516 1 6
3. Interests and Dividends received—		
Interests, ...	£926 6 8	
Dividends, ...	1,553 15 8	
		2,480 2 4
4. Income from Building Fund, ...		13 12 3
5. Receipts in connection with former Shows, . . .		891 17 6
6. Transactions—Proceeds of Sales from Messrs Blackwood, .		9 0 10
7. Balance of Receipts from Melrose Show, ...		1,411 2 2
Sum of Income, . . .		£6,321 16 7

EXPENDITURE.

1. Establishment—			
Salaries and Wages, ...		£1,372 0 0	
Feu-duties, Taxes, Coals, Gas, Insurance, Repairs and Furnishings, . . .		115 18 6	
		£1,487 18 6	
2. Fee to Auditor for 1887-88, ...		50 0 0	
3. Fee to Practical Engineer, ...		20 0 0	
4. Agricultural Education (including Bursaries and Fees to Examiners), ...		281 8 0	
5. Chemical Department, ...		713 7 6	
6. Veterinary Department, ...		41 13 0	
7. Botanical Department, ...		55 0 0	
8. Special Grants, ...		200 0 0	
9. Transactions, ...		384 7 4	
10. Essays and Reports, ...		53 15 0	
11. Ordinary Printing, Advertising, Stationery, Postages, and Bank Charges, ...		225 9 4	
12. Subscriptions to Public Societies, ...		25 0 0	
13. Miscellaneous, ...		135 2 8	
14. Premiums—			
Glasgow Show, 1888, . . .	£385 0 0		
Melrose Show, 1889, . . .	1,971 11 8		
District Competitions, . . .	386 6 2		
Cottages and Gardens, . . .	33 17 4		
		2,776 15 2	
15. Payments in connection with former Shows, .		17 11 10	
Sum of Expenditure, . .			6,467 8 4
Balance of Expenditure, ...			£145 11 9

W. S. WALKER, *Treasurer.*
JAS. AULDJO JAMIESON, *Chairman of Finance Committee.*
WM. HOME COOK, C.A., *Auditor.*

Edinburgh, *7th January* 1890.

ABSTRACT of the ACCOUNTS of the HIGHLAND and

CHARGE.

1. DEPOSIT RECEIPT with Royal Bank of Scotland in name of Building Fund, ...			£75 11 5
2. ARREARS of Annual Subscriptions at 30th Nov. 1888,		£72 16 6	
Whereof due by Members who have now compounded for life, and are thereby extinguished, . .	£6 7 0		
Sums ordered to be struck off, .	43 19 0		
		50 6 0	
			22 10 6
3. INTERESTS AND DIVIDENDS—			
(1) Interest on Heritable Bonds, less Income-tax,		£588 14 4	
(2) Interest on Debenture Bonds, Do.		78 0 0	
(3) Interest on Debenture Stock, Do.		269 13 2	
		£936 7 6	
Deduct.—Interest on Overdraft on Account Current with Royal Bank of Scotland for year to 30th November 1889, . .	£35 19 0		
Less.—Interest on Deposit with Royal Bank of Scotland for £2,450 from 30th November 1888 to 7th February 1889, . .	25 18 2		
		10 0 10	
		£926 6 8	
(4) Dividends on Bank Stocks—			
£6,407, 7s. 8d. Royal Bank of Scotland, .	£576 13 2		
2,218, 6s. 5d. Bank of England, .	227 8 6		
2,000, 0s. 0d. British Linen Co. Bank, .	280 0 0		
1,250, 0s. 0d. National Bank of Scotland, .	187 10 0		
1,080, 0s. 0d. Commercial Bank of Scotland, .	151 4 0		
1,091, 13s. 4d. Bank of Scotland, .	131 0 0		
£14,047, 7s. 5d.		1,553 15 8	
			2,480 2 4
4. INCOME from Building Fund—			
Interest on Heritable Bond for £350, less tax, .		£11 18 10	
Interest on Deposits with Royal Bank, . .		1 13 5	
			13 12 3
5. SUBSCRIPTIONS—			
Annual Subscriptions, ...		£788 0 0	
Life Subscriptions, ...		791 16 0	
			1,579 16 0
6. RECEIPTS in connection with former Shows, ...			891 17 6
7. TRANSACTIONS—Proceeds of Sales from Messrs Blackwood, .			9 0 10
8. BALANCE of Receipts from Melrose Show, ...			1,411 2 2
9. CAPITAL realised, being Sum deposited with Royal Bank of Scotland in reduction of Overdraft, ...			2,450 0 0
10. BALANCE due to Royal Bank of Scotland on Account Current, as at 30th November 1889, ...			754 0 0
SUM OF CHARGE, . .			£9,687 13 0

EDINBURGH, *7th January* 1890.

AGRICULTURAL SOCIETY of SCOTLAND for the Year 1888-89.

DISCHARGE.

1. Balance due to Royal Bank of Scotland on Account Current at 30th November 1888,			£3,044 16 0
2. Establishment Expenses—			
Salary to Secretary,		£850 0 0	
Salary to Clerk, £300; Second Clerk, £150,		450 0 0	
Wages to Messenger,		72 0 0	
Feu-duty, £28; Water Rates, £2, 3s. 4d.; Taxes, £33, 16s. 4d.,		63 19 8	
Coals and Firewood, £10, 8s. 6d.; Gas, £8, 0s. 9d.; Insurance, £8, 14s. 8d.,		27 3 11	
Repairs and Furnishings,		24 14 11	
			1,487 18 6
3. Fee to Auditor,			50 0 0
4. Fee to Practical Engineer,			20 0 0
5. Agricultural Education— Grant to Professor of Agriculture, £150; Prizes to Class, £10; Bursaries, £80; Fees to Examiners, Expenses, and Luncheons, £41, 8s.,			281 8 0
6. Chemical Department—			
Salary to Chemist, £300; Allowance for Expenses, £300,		£600 0 0	
Experimental Station at Pumpherston—Rent of ground for half-year to Whitsunday 1889, £6, 10s.; Manures, £3, 15s.; Superintendent's Allowance, £15, 15s.,		26 0 0	
Manures for District Experiments,		6 0 0	
Grants to Analytical Associations,		77 15 0	
Printing,		3 12 6	
			713 7 6
7. Veterinary Department—Fee to Professor Williams, £26, 5s.; Medals to Students, £15, 8s.,			41 13 0
8. Botanical Department—Fee to Botanist, £25; Outlays in connection with Experiments on Grasses, £30,			55 0 0
9. Special Grants—Vote to Dairy Department, £100; Vote to Glasgow and West of Scotland Technical College, £100,			200 0 0
10. Society's Transactions—Printing, £195, 10s. 4d.; Binding and Postage, £131, 15s.; Printing Index to Transactions, 1866-1888, £44; Binding, £11; Delivering Transactions, £2, 2s.			384 7 4
11. Essays and Reports,			53 15 0
12. Ordinary Printing and Lithographing, £94, 17s. 3d.; Advertising, £28, 3s.; Stationery, Books, &c., £30, 9s. 2d.; Postage and Receipt Stamps, £58; Bank and Post-Office Charges and Telegrams, £13, 13s. 4d.,			225 2 9
13. Subscriptions to Public Societies—Scottish Meteorological Society, £20; Society for Prevention of Cruelty to Animals, £5,			25 0 0
14. Miscellaneous Payments—Expenses of Deputation of three Directors and Secretary to London, regarding Transit of Cattle from Ireland, Pleuro-Pneumonia, &c., £36, 3s. 8d.; Secretary's Expenses attending Nomination of Directors, £23, 1s. 6d.; Extra Clerks, £32, 7s. 6d.; Reporting Board Meetings, £21; Luncheons to Directors, £10, 11s. 9d.; Translating Papers, £4, 14s. 6d.; Storing Turnstiles, £5; Sundries, £2, 10s. 4d.,			135 9 3
15. Premiums—			
Glasgow Show, 1888,		£385 0 0	
Melrose Show, 1889,		1,971 11 8	
		£2,356 11 8	
District Competitions,	£386 6 2		
Cottages and Gardens,	33 17 4		
		420 3 6	
			2,776 15 2
16. Payments in connection with former Shows,			17 11 10
17. Arrears of Subscriptions struck off as irrecoverable,			38 0 6
18. Arrears considered recoverable,			48 4 6
19. Sum on Deposit Receipt with Royal Bank of Scotland, of date 11th November 1889, in name of Building Fund,			89 3 8
Sum of Discharge,			£9,687 13 0

W. S. WALKER, *Treasurer.*
JAS. AULDJO JAMIESON, *Chairman of Finance Committee.*
WM. HOME COOK, C.A., *Auditor.*

ABSTRACT of ACCOUNTS of the MELROSE SHOW, 1889.

CHARGE.

1. Local Subscriptions—		
Voluntary Assessment on Proprietors—		
Berwickshire, ...		£215 0 0
Roxburghshire, ...		387 19 11
Selkirkshire, ...		98 13 9
Peeblesshire, ...		90 9 4
Contribution from Berwickshire Agricultural Association, .		10 10 0
		£802 13 0
2. Amount Collected during Show—		
Drawn at Gates, ...	£1,873 6 6	
Drawn at Grand Stand, ...	169 5 3	
Catalogues and Awards sold, . . .	169 9 6	
Drawn at Lavatory, ...	2 1 6	
		2,214 2 9
3. Rent of Stalls, ...		1,239 4 6
4. Rent of Refreshment Booths, ...		200 0 0
5. Income from Tweeddale Medal Fund, ...		18 5 8
6. Subscriptions in Aid of Premiums, ...		217 0 0
7. Fines for Non-Exhibition of Live Stock, ...		85 5 0
8. Interest from Royal Bank, ...		12 18 11
		£4,789 9 10
Balance of Payments, . .		560 9 6

Note.—To the above Balance of . .	£560 9 6
There must be added the Premiums undrawn at 30th November 1889, amounting to . . .	168 10 0
Making the Probable Loss,	£728 19 6

	£5,349 19 4

Edinburgh, *7th January* 1890.

ABSTRACT of ACCOUNTS of the MELROSE SHOW, 1889.

DISCHARGE.

1. Showyard Expenditure—		
Fitting up Showyard,		£1,896 0 0
Railway Carriage of Hurdles and other Plant from Glasgow,		15 13 6
Railway Carriage and Cartage of Turnstiles, Catalogues, &c.,		15 5 8
Clerk of Works,		13 7 6
Restoring Fence of Field,		12 0 0
Rosettes and Blue Tape,		8 2 0
Plan of Showyard,		5 5 0
Repairing Turnstiles,		3 10 8
Gratuities to Foremen Workmen,		3 0 0
Repairing Crane,		2 10 0
Miscellaneous,		5 2 7
		£1,979 16 11
2. Forage and Bedding for Stock,		321 8 3
3. Police,		48 5 4
4. Travelling Expenses of Judges, Stewards, Secretary, and Assistants (42 in all),		104 0 3
5. Allowance to 30 Judges in lieu of Hotel Accommodation,		120 0 0
6. Hotel Bills—		
28 Directors, 5 Stewards and Secretary (including Sitting Rooms and gratuities to servants),	£114 7 9	
Auditor's expenses, £5, 14s. 9d.; Two Clerks, 10 days at 21s. each allowance per day, £21,	26 14 9	
Extra Assistants and Attendants, and Veterinary Inspector,	33 16 3	
Luncheons in Committee Rooms for Judges, Attending Members, and Members of Committee, and Breakfasts for Stewards, Assistants, and others,	84 0 0	
		258 18 9
7. Banquet,		11 12 6
8. Music in Showyard,		57 7 0
9. Printing and Lithographing,		145 11 6
10. Advertising and Bill-posting,		78 2 8
11. Veterinary Inspector,		7 0 0
12. Practical Engineer—		
Fees, 12 days at £4, 4s. per day,	£50 8 0	
Fares and Personal Expenses,	12 19 0	
		63 7 0
13. Extra Clerks, Assistants, and Attendants at Turnstiles, Gates, &c.,		137 15 11
14. Postages,		43 5 0
15. Miscellaneous Outlays,		1 16 7
Amount of General Expenses,		£3,378 7 8
16. Premiums drawn at 30th November 1889,		1,971 11 8
		£5,349 19 4

W. S. WALKER, *Treasurer.*
JAS. AULDJO JAMIESON, *Chairman of Finance Committee.*
WM. HOME COOK, C.A., *Auditor.*

ABSTRACT of the ACCOUNTS of the ARGYLL NAVAL FUND for 1888-89.

CHARGE.

1. FUNDS as at 30th November 1888—			
Debenture Stock of the North British Railway Company, .			£1,200 0 0
Funded Debt of the Clyde Navigation Trustees, £3,000, purchased at			2,970 0 0
Stock of the Royal Bank of Scotland, £305, purchased at .			671 0 0
Loan on Heritable Security at 4 per cent, ...			1,200 0 0
			£6,041 0 0
BALANCE in Bank at 30th November 1888—			
On Deposit Receipt, ...		£130 0 0	
On Current Account, ...		219 13 1	
			379 13 1
			£6,420 13 1
2. INCOME received—			
On £1,200 North British Railway Company Debenture Stock at 4¼ per cent, £51, less tax £1, 5s. 6d., ...		£49 14 6	
On £3,000 Funded Debt of the Clyde Navigation Trustees at 4 per cent, £120, less tax £3, .		117 0 0	
On £305 Royal Bank Stock, ...		27 9 0	
On £1,200 lent on Heritable Security, at 4 per cent, £48, less tax £1, 4s., ...		46 16 0	
		£240 19 6	
On Balances in Bank—			
On Deposit Receipt, . .	£4 18 11		
On Current Account, . .	1 9 5		
		6 8 4	
			247 7 10
SUM OF CHARGE, . .			£6,668 0 11

DISCHARGE.

1. ALLOWANCES to the five following Recipients—			
Colin Mackenzie, first year, ...			£40 0 0
C. W. Campbell Strickland, first year, ...			40 0 0
Edward A. Baird, fifth year, ...			40 0 0
G. P. W. Hope, seventh year, ...			40 0 0
Lewis Wentworth Chetwynd, tenth and last year, . .			40 0 0
			£200 0 0
2. FUNDS as at 30th November 1889—			
Debenture Stock of the North British Railway Company, ...		£1,200 0 0	
Funded Debt of the Clyde Navigation Trustees, £3,000, purchased at		2,970 0 0	
Stock of the Royal Bank of Scotland, £305, purchased at		671 0 0	
Loan on Heritable Security, at 4 per cent, .		1,200 0 0	
		£6,041 0 0	
Balance in Royal Bank of Scotland at 30th November 1889—			
On Deposit Receipt, . . .	£134 18 11		
On Current Account, . . .	292 2 0		
		427 0 11	
			6,468 0 11
SUM OF DISCHARGE, . .			£6,668 0 11

W. S. WALKER, *Treasurer.*
JAS. AULDJO JAMIESON, *Chairman of Finance Committee.*
WM. HOME COOK, C.A., *Auditor.*

EDINBURGH, *7th January* 1890.

APPENDIX (B).

PREMIUMS

OFFERED BY

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND IN 1890.

CONTENTS.

PAGE
General Notice 3
Constitution and Management 4
Establishment for 1890 5
Meetings for 1890 7
Committees 8
Agricultural Education 11
Veterinary Department 21
Forestry Department 21
Chemical Department 26
Botanical Department 42
Dairy Department 43
General Regulations for Competitors 44

CLASS I.—REPORTS.

§ 1. The Science and Practice of Agriculture—For Approved Reports on—

1. Experiments for fixing the ingredients in Farmyard Manure 45
2. Manures produced by different kinds of Feeding . . 45
3. Adjusting Produce Rents 45
4. Farm Accounts 46
5. Pig-rearing 46
6. Poultry Raising 46
7. Vegetable Productions of India, China, and America . 46
8. Best mode of housing Fattening Cattle . . . 46
9. Different descriptions of Food for Stock . . . 47
10. Dairy Management 47
11. Comparative Feeding Value of Ensilage . . . 47
12. Pasture Plants, indigenous or naturalised . . . 47
13. Rural Economy abroad susceptible of being introduced into Scotland 47

§ 2. Estate Improvements—For Approved Reports on—

1. General Improvement of Estates by Proprietors . . 48
2. Most approved Farm Buildings by Proprietors . . 48
3, 4, and 5. Reclamation of Waste Land by Proprietors or Tenants 48
6 and 7. Improvement of Natural Pasture by Proprietors or Tenants 49

§ 3. Highland Industries and Fisheries—For Approved Reports on—

1. Mode of treating native Wool 49
2. Preventing Extinction of the Lobster . . . 49
3. Utilising the Sprat Fisheries 49

§ 4. Machinery—

1. The Advantages or Disadvantages of using the American Chilled Plough in comparison with the old Scotch or Swing Plough 49

§ 5. Forestry Department—For Approved Reports on—

1. Planting on Peat Bog 49
2. Forest Trees of recent introduction 50
3. Insects injurious to British Forest Trees . . 50
4. Utilisation of Waste Produce of Forests . . . 50

CLASS II.—DISTRICT COMPETITIONS.

1. Stock 50
2. Dairy Produce 55
3. Special Grants 57
4. Medals in aid of Premiums given by Local Societies . . 58
5. Ploughing Competitions 62

CLASS III.—COTTAGES AND GARDENS.

1. Premiums for Best Kept Cottages and Gardens . . 63
2. Medals for Cottages and Gardens or Garden Produce . 64
3. Improving Existing Cottages 66
4. Building New Cottages 66

GENERAL SHOW AT DUNDEE IN 1890 67

LIST OF MEMBERS ADMITTED SINCE APRIL 1889 . . 87

GENERAL NOTICE.

THE HIGHLAND SOCIETY was instituted in the year 1784, and incorporated by Royal Charter in 1787. Its operation was at first limited to matters connected with the improvement of the Highlands of Scotland; but the supervision of certain departments, proper to that part of the country, having been subsequently committed to special Boards of Management, several of the earlier objects contemplated by the Society were abandoned, while the progress of agriculture led to the adoption of others of a more general character. The exertions of the Society were thus early extended to the whole of Scotland, and have, for the greater part of a century, been directed to the promotion of the science and practice of agriculture in all its branches.

In accordance with this more enlarged sphere of action, the original title of the Society was altered, under a Royal Charter, in 1834, to THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

The leading purposes of the Institution are set forth in the following pages, where it will be found that Premiums are offered for Reports on almost every subject connected with the cultivation of the soil; the rearing and feeding of stock; the management of the dairy; the improvement of agricultural machinery and implements; the growth of timber; the extension of cottage accommodation; the application of chemical science; and the dissemination of veterinary information.

Among the more important measures which have been effected by the Society are—

1. Agricultural Meetings and General Shows of Stock, Implements, &c., held in the principal towns of Scotland, at which exhibitors from all parts of the United Kingdom are allowed to compete.

2. A system of District Shows instituted for the purpose of improving the breeds of Stock most suitable for different parts of the country, and of aiding and directing the efforts of Local Agricultural Associations.

3. The encouragement of Agricultural Education, under powers conferred by a supplementary Royal Charter, granted in 1856, and authorising "THE COUNCIL of the HIGHLAND AND AGRICULTURAL SOCIETY ON EDUCATION" to grant Diplomas to Students of Agriculture; and by the establishment of Bursaries.

4. The appointment of a chemist for the purpose of promoting the application of science to agriculture, and to superintend local experiments. Also to subsidise, under certain conditions, Local Analytical Associations.

5. The advancement of the Veterinary Art, by conferring Certificates on Students who have passed through a prescribed curriculum, and who are found, by public examination, qualified to practise. Now terminated in accordance with arrangements with the Royal College of Veterinary Surgeons.

6. The establishment of a Botanical Department.

7. The establishment of a Dairy Department.

8. The appointment of a Board of Examiners, and the granting of First and Second Class Certificates in Forestry.

9. The annual publication of the 'Transactions,' which comprehend the Prize Reports, and reports of experiments, also an abstract of the business at Board and General Meetings, and other communications.

10. The management of a fund left by John, 5th Duke of Argyll (the original President of the Society) to assist young natives of the Highlands who enter Her Majesty's Navy.

CONSTITUTION AND MANAGEMENT.

THE general business of the HIGHLAND AND AGRICULTURAL SOCIETY is conducted under the sanction and control of a Royal Charter, which authorises the enactment of Bye-Laws. Business connected with Agricultural Education is conducted under the authority of a supplementary Royal Charter, also authorising the enactment of Bye-Laws.

The Office-Bearers consist of a President, Four Vice-Presidents, Thirty-two Ordinary and Twenty Extraordinary Directors, a Treasurer, an Honorary and an Acting Secretary, an Auditor, and other Officers.

The Directors meet on the first Wednesday of each month from November to June; seven being a quorum. The proceedings of the Directors are reported to General Meetings of the Society, held in January and in June or July.

With reference to motions at General Meetings, Bye-Law No. 10 provides—"That at General Meetings of the Society no motion or proposal (except of mere form or courtesy) shall be submitted or entertained for immediate decision unless notice thereof has been given a week previously to the Board of Directors, without prejudice, however, to the competency of making such motion or proposal to the effect of its being remitted to the Directors for consideration, and thereafter being disposed of at a future General Meeting."

The Council on Education, under the Supplementary Charter, consists of Sixteen Members—Nine nominated by the Charter, and Seven elected by the Society. The Board of Examiners consists of Sixteen Members.

Candidates for admission to the Society must be proposed by a Member, and are elected at the half-yearly General Meetings in January and June or July, but it is not necessary that the proposer should attend the meeting. The ordinary subscription is £1, 3s. 6d. annually, which may be redeemed by one payment, varying, according to the number of previous annual payments, from £7, 1s. to £12, 12s. Proprietors farming the whole of their own lands, whose rental on the Valuation Roll does not exceed £500 per annum, and all Tenant-Farmers, Secretaries or Treasurers of Local Agricultural Associations, Factors resident on Estates, Land-Stewards, Foresters, Agricultural Implement Makers, and Veterinary Surgeons, none of them being also owners of land to an extent exceeding £500 per annum, are admitted on a subscription of 10s. annually, which may be redeemed by one payment, varying, according to the number of previous annual payments, from £3 to £5, 5s. Subscriptions payable on election, and afterwards annually in January. According to the Charter, a Member who homolgates his election by paying his first subscription cannot retire until he has paid in annual subscriptions, or otherwise, an amount equivalent to a life composition—namely, £12, 12s. or £5, 5s. Members having candidates to propose are requested to state whether the candidate should be on the £1, 3s. 6d. or 10s. list.

Members of the Society receive the 'Transactions' free on application to the Secretary, and are entitled to consult the Chemist and Botanist at reduced rates—to apply for District Premiums—to report Ploughing Matches for the Medal—to free admission to the Showyard, and to exhibit Stock at reduced rates. Firms are not admitted as Members, but if one partner of a firm becomes a Member, the firm is allowed to exhibit at Members' rates.

Orders, payable at the Royal Bank of Scotland, Edinburgh, are issued by the Directors, in name of the persons in whose favour Premiums have been awarded.

All communications must be addressed to "FLETCHER NORTON MENZIES, Esq., Secretary of the Highland and Agricultural Society of Scotland, No. 3 George IV. Bridge, Edinburgh."

ESTABLISHMENT FOR 1890.

President.

The Right Hon. the EARL OF STRATHMORE, Glamis Castle, Glamis.

Vice-Presidents.

The Earl of Airlie, Cortachy Castle, Kirriemuir.
Colonel John Anstruther Thomson of Charleton, Colinsburgh.
James M'Queen of Crofts, Dalbeattie.
Jonathan Middleton, Clay of Allan, Fearn, Ross-shire.

Ordinary Directors.

David Buttar, Corston, Coupar-Angus.
James Park, Dechmont, Cambuslang.
Walter Elliot, Hollybush, Galashiels.
Patrick Stirling of Kippendavie, Dunblane.
Campbell Macpherson Grant of Drumduan, Forres.
George R. Glendinning, Hatton Mains, Wilkieston.
Sir John Innes of Balveny and Edengight, Bart., Keith.
Robt. F. Dudgeon, yr. of Cargen, Kirkcudbright.
John Lorne Stewart of Coll, Oban.
James T. S. Elliot of Wolfelee, Hawick.
David Buchanan, Garscadden Mains, New Kilpatrick.
Andrew Mackenzie, Dalmore, Alness.
Sir James H. Gibson-Craig of Riccarton, Bart., Currie.
John Marr, Cairnbrogie, Old Meldrum.
Rev. John Gillespie, Mouswald Manse, Ruthwell, R.S.O.
Alexander Macduff of Bonhard, Perth.
Sir James R. Maitland of Barnton, Bart., Craigend, Stirling.
J. H. Turner, The Dean, Kilmarnock.
John Ballingall, Dunbog, Newburgh, Fife.
William Ford, Fentonbarns, Drem.
W. H. Lumsden of Balmedie, Aberdeen.
W. J. Maxwell, yr. of Munches, Terraughtie, Dumfries.
Duncan Forbes of Culloden, Inverness.
R. Shirra Gibb, Boon, Lauder.
Thomas D. Findlay of Easterhill, Tollcross, Glasgow.
John Gilmour of Montrave, Leven, Fife.
Donald Fisher, Jellyholm, Alloa.
R. G. Wardlaw Ramsay of Whitehill, Rosewell.
G. Wilken, Waterside of Forbes, Alford, N.B.
James Lockhart, Mains of Airies, Stranraer.
John Cran, Kirkton, Bunchrew, Inverness.
The Hon. The Master of Polwarth, Mertoun House, St Boswells.

Extraordinary Directors.

William Hunter, Lord Provost of Dundee.
Sir John Ogilvy of Inverquharity, Bart., Baldovan House, Dundee.
Sir Alexander Muir Mackenzie of Delvine, Bart., Dunkeld.

John Balfour of Balbirnie, Markinch.
Hugh Ballingall, Park and Pleasance Breweries, Dundee.
William Ogilvy Dalgleish of Errol Park, Errol.
William Dingwall, Ramornie, Ladybank.
Captain G. D. Clayhills Henderson of Invergowrie, R.N., Dundee.
Andrew Ralston, Glamis House, Glamis.
Andrew Whitton of Couston, Newtyle.
The Hon. Robt. Baillie Hamilton of Langton, Duns.
Sir Robert Menzies of Menzies, Bart., Farleyer, Aberfeldy.
Colin J. Mackenzie of Portmore, Eshiels, Peebles.
George J. Walker, Portlethen, Aberdeen.
John Kerr, Broomhouse, Corstorphine.
Thomas Elliot, Blackhaugh, Galashiels.
F. E. Villiers of Closeburn Hall, Thornhill.
Alexander Murdoch, Gartcraig, Shettleston.
Chas. Howatson, House of Glenbuck, Glenbuck.
Andrew Allan, Munnoch, Dalry, Ayrshire.

Office-Bearers.

Sir William Stuart Walker, K.C.B., *Treasurer.*
Sir G. Graham Montgomery of Stanhope, Bart., *Honorary Secretary.*
Fletcher Norton Menzies, *Secretary.*
Rev. James Grant, D.C.L., D.D., *Chaplain.*
Andrew P. Aitken, D.Sc., *Chemist.*
William Home Cook, C.A., *Auditor.*
Tods, Murray, & Jamieson, W.S., *Law Agents.*
A. N. M'Alpine, *Consulting Botanist.*
James D. Park, *Practical Engineer.*
Thomas Duncan, *Recorder and Clerk.*
John Macdiarmid, *Second Clerk.*
Gourlay Steell, R.S.A., *Animal Portrait Painter.*
William Williams, F.R.C.V.S., *Professor of Veterinary Surgery.*
Thomas Walley, M.R.C.V.S., *Professor of Cattle Pathology.*
William Blackwood & Sons, *Printers and Publishers.*
G. Waterston & Sons, *Stationers.*
James Crichton & Co., *Silversmiths and Medallists.*
John Watherston & Sons, *Inspectors of Works.*
William Simpson, *Messenger.*

Chairmen of Committees.

1.	*Argyll Naval Fund,* . .	Admiral Maitland Dougall of Scotscraig, R.N., Tayport.
2.	*Chemical and Botanical,* .	C. J. Mackenzie of Portmore, Eshiels, Peebles.
3.	*Dairy and Veterinary,* .	Sir James H. Gibson-Craig of Riccarton, Bart., Currie.
4.	*District Shows, and Cottages and Gardens,* . . .	F. E. Villiers of Closeburn Hall, Thornhill.
5.	*Finance, Hall and Chambers, and Law,* . . .	James Auldjo Jamieson, W.S., 66 Queen Street, Edinburgh.
6.	*Forestry and Highland Industries,*	Sir Robert Menzies, Bart., Farleyer, Aberfeldy.
7.	*General Shows,* . . .	Patrick Stirling of Kippendavie, Dunblane.
8.	*Machinery,*	Jonathan Middleton, Clay of Allan, Fearn.
9.	*Publications, Ordnance Survey, and Reports of Meetings,*	Rev. John Gillespie, Mouswald Manse, Ruthwell, R.S.O.

General Meetings.—By the Charter the Society must hold two General Meetings each year, and, under ordinary circumstances, they are held on the third Wednesday of the months of January and June, at one o'clock, in the Society's Hall, 3 George IV. Bridge, for the election of Members and other business.

Meeting at Dundee.—By a resolution of the General Meeting on 15th January 1879, a General Meeting of Members is held in the Showyard on the occasion of the Annual Show. This year it will be held at Dundee, on Wednesday, 30th July, at 11.30 A.M.

General Show at Dundee—29th, 30th, and 31st July, and 1st August.—Entries close for Implements, 16th May—Stock, Poultry, and Dairy Produce, 13th June.

Directors' Meetings.—The Board of Directors meet on the first Wednesday of each month from November till June inclusive, at *one* P.M., and occasionally as business may require, on a requisition by three Directors to the Secretary, or on intimation by him.

Nomination of Directors.—Meetings of Members, for the purpose of nominating Directors to represent the Show Districts on the Board, will be held at the places and on the days after mentioned :—

1. Glasgow, George Hotel, ...	Wednesday, 6th Aug., at 1.
2. Perth, Salutation Hotel, ...	Friday, 8th August, at 1.
3. Stirling, Golden Lion Hotel, . . .	Friday, 15th August, at 1.
4. Edinburgh, 3 George IV. Bridge, . .	Wednesday, 20th Aug., at 2.
5. Aberdeen, Imperial Hotel, . . .	Friday, 22d August, at 1.
6. Dumfries, King's Arms Hotel, . .	Wednesday, 27th Aug., at 1.
7. Inverness, Caledonian Hotel, . . .	Friday, 29th Aug., at 12.30.
8. Kelso, Secretary's Tent, Ram Sale Ground,	Friday, 12th Sept., at 1.

The nomination of Proprietors or other Members paying the higher subscription must be made in the 3d, 5th, 6th, and 7th Districts ; and the nomination of Tenant-Farmers or other Members paying the lower subscription, in the 1st, 2d, 4th, and 8th Districts.

Committee Meetings.

Forestry and Highland Industries.—First Tuesday in November, at 12 noon.

Machinery.—First Tuesday in November, at 1 P.M.

General Shows.—First Tuesday in November, at 2 P.M.

Publications, Ordnance Survey, and Reports of Meetings.—First Wednesday in November, at 12 noon, and first Wednesday in January, 12 noon.

District Shows, and Cottages and Gardens.—First Tuesday in December, at 12 noon.

Chemical and Botanical.—First Tuesday in December, at 2 P.M., and first Tuesday in March, at 2 P.M.

The other Standing Committees—ARGYLL NAVAL FUND ; FINANCE, HALL AND CHAMBERS, AND LAW ; DAIRY AND VETERINARY, meet when required.

Examinations for the Society's Diploma and Certificate in Agriculture and Certificates in Forestry are fixed to be held on the 26th, 27th, and 28th March.

Examinations for the Society's Bursaries are held annually in October.

COMMITTEES FOR 1890.

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1. ARGYLL NAVAL FUND.

Admiral Maitland Dougall of Scotscraig, R.N., Tayport, *Convener.*
Lord Elphinstone, Carberry Tower, Musselburgh.
The Hon. Robert Baillie Hamilton of Langton, Duns.
Sir David Baird of Newbyth, Bart., Prestonkirk.
Duncan Forbes of Culloden, Inverness.
Captain G. D. Clayhills Henderson of Invergowrie, R.N., Dundee.

2. CHEMICAL AND BOTANICAL.

C. J. Mackenzie of Portmore, Eshiels, Peebles, *Convener.*
James M'Queen of Crofts, Dalbeattie, *Vice-Convener.*
Prof. Bayley Balfour, Inverleith House.
David Buttar, Corston, Coupar-Angus.
Dr Cleghorn of Stravithy, St Andrews.
R. F. Dudgeon, The Grange, Kirkcudbright.
R. Shirra Gibb, Boon, Lauder.
G. R. Glendinning, Hatton Mains, Wilkieston.
John Marr, Cairnbrogie, Old Meldrum.
Jonathan Middleton, Clay of Allan, Fearn, Ross-shire.
John Speir, Newton Farm, Newton, Glasgow.
David Wilson, yr. of Carbeth, Killearn.
James Macdonald, Editor 'Farming World,' Edinburgh.
George Henderson, Shidlaw, Coldstream.
Dr Aitken, Chemist, *ex officio.*
A. N. M'Alpine, Botanist, *ex officio.*

3. DAIRY AND VETERINARY.

Sir James H. Gibson-Craig of Riccarton, Bart., Currie, *Convener.*
James M'Queen of Crofts, Dalbeattie, *Vice-Convener.*
Andrew Allan, Munnoch, Dalry, Ayr.
Rev. John Gillespie, Mouswald Manse, Ruthwell, R.S.O.
John Gilmour of Montrave, Leven.
Andrew Mackenzie, Dalmore, Alness.
W. J. Maxwell, yr. of Munches, Terraughtie, Dumfries.
John Milne, Inverurie.
Patrick Stirling of Kippendavie, Dunblane.
J. H. Turner, The Dean, Kilmarnock.
George J. Walker, Portlethen, Aberdeen.
James Lockhart, Mains of Airies, Stranraer.
Professor Williams, *ex officio.*
Dr Aitken, *ex officio.*

4. DISTRICT SHOWS, AND COTTAGES AND GARDENS.

F. E. Villiers of Closeburn Hall, Thornhill, *Convener.*
W. H. Lumsden of Balmedie, Aberdeen, *Vice-Convener.*
Hon. R. Baillie Hamilton of Langton, Duns.
David Buttar, Corston, Coupar-Angus.
John Ballingall, Dunbog, Newburgh, Fife.
John Cran, Kirkton, Bunchrew, Inverness.
Walter Elliot, Hollybush, Galashiels.
G. R. Glendinning, Hatton Mains, Wilkieston.
Charles Howatson, House of Glenbuck, Glenbuck.
Alex. Murdoch, Gartcraig, Shettleston.
James T. S. Elliot of Wolfelee, Hawick.
The Hon. the Master of Polwarth, Mertoun House, St Boswells.

5. FINANCE, HALL AND CHAMBERS, AND LAW.

James Auldjo Jamieson, W.S., 66 Queen Street, Edinburgh, *Convener.*
Sir James H. Gibson-Craig of Riccarton, Bart., *Vice-Convener.*
Hon. R. Baillie Hamilton of Langton, Duns.
Rev. John Gillespie, Mouswald Manse, Ruthwell, R.S.O.
Alex. Macduff of Bonhard, Perth.
W. J. Maxwell, yr. of Munches, Terraughtie, Dumfries.
Patrick Stirling of Kippendavie, Dunblane.
F. E. Villiers of Closeburn Hall, Thornhill.
William Home Cook, C.A., Auditor, *ex officio.*

6. FORESTRY AND HIGHLAND INDUSTRIES.

Sir Robert Menzies, Bart., Farleyer, Aberfeldy, *Convener.*
Sir James R. Maitland of Barnton, Bart., Craigend, Stirling.
William Anderson Smith, Ledaig, Argyllshire.
Dr Cleghorn of Stravithy, St Andrews.
Duncan Forbes of Culloden, Inverness.
C. Macpherson Grant of Drumduan, Forres.
John MacGregor, Ladywell, Dunkeld.
John Methven, 15 Princes Street, Edinburgh.
Sir Alexander Muir Mackenzie of Delvine, Bart., Dunkeld.

7. GENERAL SHOWS.

Patrick Stirling of Kippendavie, Dunblane, *Convener.*
F. E. Villiers of Closeburn Hall, Thornhill, *Vice-Convener.*
Hon. R. Baillie Hamilton of Langton, Duns.
Sir Robert Menzies, Bart., Farleyer, Aberfeldy.
Sir James H. Gibson-Craig of Riccarton, Bart., Currie.
Andrew Allan, Munnoch, Dalry, Ayr.
David Buttar, Corston, Coupar-Angus.
John Cran, Kirkton, Bunchrew, Inverness.
Walter Elliot, Hollybush, Galashiels.
William Ford, Fentonbarns, Drem.
Rev. John Gillespie, Mouswald Manse, Ruthwell, R.S O.
John Gilmour of Montrave, Leven.
C. Macpherson Grant of Drumduan, Forres.
Charles Howatson, House of Glenbuck, Glenbuck.
W. H. Lumsden of Balmedie, Aberdeen.
Alex. Macduff of Bonhard, Perth.
Andrew Mackenzie, Dalmore, Alness.
James M'Queen of Crofts, Dalbeattie.
John Marr, Cairnbrogie, Old Meldrum.

W. J. MAXWELL, yr. of Munches, Terraughtie, Dumfries.
ALEX. MURDOCH, Gartcraig, Shettleston.
JAMES PARK, Dechmont, Cambuslang.
J. H. TURNER, The Dean, Kilmarnock.
JAMES LOCKHART, Mains of Airies, Stranraer.
G. WILKEN, Waterside of Forbes, Alford, N.B.
The Hon. the MASTER OF POLWARTH, Mertoun House, St Boswells.
JAMES D. PARK, Engineer, *ex officio.*

8. MACHINERY.

JONATHAN MIDDLETON, Clay of Allan, Fearn, *Convener.*
JOHN SCOTT DUDGEON, Longnewton, St Boswells.
WALTER ELLIOT, Hollybush, Galashiels.
J. T. S. ELLIOT of Wolfelee, Hawick.
DONALD FISHER, Jellyholm, Alloa.
JOHN KEMP, Stirling.
A. S. LOGAN, Ferney Castle, Reston.
JOHN MARSHALL, Maybole.
JOHN MUNRO of Kinloss, Cupar Fife.
J. T. S. PATERSON, Plean Farm, Bannockburn.
JOHN YOUNG, jun., Ayr.
JAMES D. PARK, Engineer, *ex officio.*

9. PUBLICATIONS, ORDNANCE SURVEY, AND REPORTS OF MEETINGS.

Rev. JOHN GILLESPIE, Mouswald Manse, Ruthwell, R.S.O., *Convener.*
R. SCOT SKIRVING, 29 Drummond Place, Edinburgh, *Vice-Convener.*
Dr A. P. AITKEN, 8 Clyde Street, Edinburgh.
Dr CLEGHORN of Stravithy, St Andrews.
J. T. S. ELLIOT of Wolfelee, Hawick.
A. F. IRVINE of Drum.
JAMES MACDONALD, Editor 'Farming World,' Edinburgh.
C. J. MACKENZIE of Portmore, Eshiels, Peebles.
R. G. WARDLAW RAMSAY of Whitehill, Rosewell.

The President, Vice-Presidents, and Honorary Secretary are members *ex officio* of all Committees.

AGRICULTURAL EDUCATION.

CERTIFICATE AND DIPLOMA IN AGRICULTURE.

COUNCIL ON EDUCATION.

By a Supplementary Charter under the Great Seal, granted in 1856, the Society is empowered to grant Diplomas.

Members of Council named by Charter.

The President of the Highland and Agricultural Society—*President.*
The Lord Justice-General—*Vice-President.*

The Lord Advocate.
The Dean of Faculty.
The Professor of Agriculture.
The Professor of Anatomy.
The Professor of Botany.
The Professor of Chemistry.
The Professor of Natural History.

Members of Council nominated by Society.

The Marquis of Lothian, K.T.
Sir William S. Walker, K.C.B.
Robert Dundas of Arniston.
John Munro of Kinloss, Cupar Fife.
Jas. Hope, East Barns, Dunbar.
Rev. John Gillespie, Mouswald, Ruthwell, R.S.O.
F. E. Villiers, Closeburn Hall, Thornhill.

Board of Examiners.

1. *Science and Practice of Agriculture.*—Professor Wallace, University, Edinburgh; John Munro of Kinloss, Cupar Fife; James Hope, East Barns, Dunbar; and Jas. Biggar, yr. of Chapelton, Dalbeattie.
2. *Botany.*—Dr Cleghorn of Stravithy, St Andrews, and A. N. M'Alpine, Edinburgh.
3. *Chemistry.*—Dr A. P. Aitken, Edinburgh, and Dr William Craig, Edinburgh.
4. *Natural History.*—Professor Cossar Ewart, Edinburgh, and Dr Ramsay H. Traquair, Edinburgh.
5. *Veterinary Science.*—Professor Williams, Edinburgh, and Finlay Dun, F.R.C.V.S., Edinburgh.
6. *Field Engineering.*—David Alan Stevenson, C.E., Edinburgh, and A. W. Belfrage, C.E., Edinburgh.
7. *Book-keeping.*—William Home Cook, C.A., Edinburgh, and J. Wilson Brodie, C.A., Edinburgh.

Standing Acting Committee.

The Lord Justice-General—*Convener.*

The Professor of Agriculture.
The Professor of Botany.
The Professor of Chemistry.
John Munro of Kinloss, Cupar Fife.
Rev. John Gillespie of Mouswald.
F. E. Villiers, Closeburn Hall, Thornhill.

BYE-LAWS.

I. That, in terms of the Charter, the Society shall nominate seven members to act on the Council on Education.

II. That the Council shall appoint a Board of Examiners on the following subjects:—Science and Practice of Agriculture; Botany; Chemistry; Natural History; Veterinary Science; Field Engineering; and Book-keeping.

III. That the examinations shall be both written and oral, that the value of the answers shall be determined by numbers, and that the oral examinations shall be public.

IV. That there shall be two examinations,[1] to be styled respectively the "First-Class Certificate Examination" and the "Diploma Examination."

V. That to pass the "First-Class Certificate Examination," a candidate must be acquainted with the science and practice of agriculture, botany, chemistry, natural history, veterinary science, field-engineering, and book-keeping; and that a certificate in the following terms, bearing the corporate seal and arms of the Society, signed by the President or Vice-President of the Council on Education, the Examiners, and by the Secretary, shall be granted to candidates passing this examination:—

"These are to certify that on the , A. B. was examined, and has been found to possess a knowledge of the science and practice of agriculture, botany, chemistry, natural history, veterinary science, field-engineering, and book-keeping."

VI. That to pass the "Diploma Examination," a candidate must possess a *thorough knowledge* of the science and practice of agriculture, botany, chemistry, natural history, veterinary science, field-engineering, and book-keeping; and that a diploma in the following terms, bearing the corporate seal and arms of the Society, and signed by the President and Vice-President of the Council on Education, the Examiners, and by the Secretary, shall be granted to candidates passing this examination:—

"These are to certify that on the , A. B. was examined, and has been found to be proficient in the science and practice of agriculture, botany, chemistry, natural history, veterinary science, field-engineering, and book-keeping."

VII. That each successful candidate for the Society's Agricultural Diploma shall thereby become eligible to be elected a free life member of the Society.

VIII. That five bursaries of £20 each shall be open for competition, the subjects of examination being the ordinary branches of an English education, the method and standard of examination to be determined by the Directors. Each candidate shall make a written declaration before being examined that it is his intention to pursue Agriculture as a business. £10 shall be paid to each holder of the bursaries on 1st March, on presentation of a certificate from the professor or teacher that he has regularly attended up to that date and obtained a certificate of at least 60 per cent in the class examinations, the class of Agriculture in the University of Edinburgh, the Technical College, Glasgow, or such other class as may be approved and sanctioned by the Board of Directors; the remaining £10 shall not be paid unless and until the bursar is awarded the Diploma of the Society, either at the close of the session or twelve months thereafter.

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[1] The examinations will be held this year on the 26th, 27th, and 28th March, candidates being required to lodge intimation before the 18th of March.

The Regulations for the Examination of Candidates for Bursaries, and Examination Papers, 1889, will be found on pages 19 and 20.

IX. That a Standing Acting Committee of the Council on Agricultural Education shall be appointed by the Directors.

Note.—The list of Diploma Free Life Members is published in vol. i., fifth series, of the Society's 'Transactions.'

The following have obtained

FIRST-CLASS CERTIFICATES.

1867. *J. C. Bowstead, Halkthorpe Hall, Penrith.
1868. James Taylor, Clashfarquhar, Aberdeen.
1873. *R. C. B. Willis, Cheltenham.
1875. George H. Catt, 44 Middle Street, Brighton.
1875. Robert Ewing, Reporter, late Edinburgh.
1875. John Scott, 20 Cockburn Street, Edinburgh.
1876. Cecil C. Baker, 2 Bloomsbury Place, London.
1876. *Percy H. Cathcart, 16 Oakley Square, London.
1876. John M'Caig, Kilhilt, Stranraer.
1876. C. E. M. Russell, Ballielisk, Dollar.
1878. W. M. Anderson, Pirntaton, Stow.
1879. *M. Falcon, Stainburn, Workington.
1880. William Brown, Watten Mains, Caithness.
1880. Alex. Inglis, Tyninghame, Prestonkirk.
1880. James M'Laggan, Cobbleheugh, Dinnet, Aberdeenshire.
1880. R. A. Malloch, Balhaldie, Braco, Perthshire.
1881. Daniel Bain, Wick.
1881. *Alfred Hardie, Oxford House, Stockport.
1882. Daniel Finlayson, Carter's, Seedsman, London.
1882. Benjamin Hepburn, Preston Mains, Prestonkirk.
1882. J. Rodger, Mertoun, St Boswells.
1883. Alex. H. Gibson, Kirkcaldy.
1883. Arthur Herbert Kerr, Crookham, Farnham.
1883. *Patrick L. Maitland, Perrymead House, Bath.
1883. Henry B. Mayne, Brantridge, Balcomb, Sussex.
1883. Robert Rouse Peter, Buenos Ayres, South America.
1884. *W. A. Sanders, Sanders Park, Co. Cork.
1884. *W. Stirling, Dean's Court, St Andrews.
1885. *Henry Chavasse, Castle Townshend, Cork.
1885. A. R. Dunnet, Auchengill, Keiss, Caithness.
1885. Alex. Edward, 1 Macdonald Street, Dundee.
1885. John M. Ramsay, Hope Park, Cupar Fife.
1886. *Basil S. Cave, Queensberry House, Richmond, Surrey.
1886. *Edgar Dudley, 37 Thornhill Road, Barnsbury, London.
1886. John Edwin Mackenzie, 15 Albany Street, Edinburgh.
1886. *J. Rennie, Wellcroft, Helensburgh.
1886. *William R. Richardson, Collyhurst Lodge, Whalley Range, Manchester.
1886. *C. G. Freer Thonger, Lordswood Place, Harborne, Staffordshire.
1887. *Khosheroo B. Jadhava, Baroda, Bombay.
1887. *Pandit Srilal, Misra, Mahaban, Dist. Muthra, N.W.P., India.
1888. D. W. Collyer, Craignethan, Weston-super-Mare, Somerset.
1888. James Kerr, Mid-Kelton, Castle Douglas.
1888. F. O. Solomon, Southfield, Dartford, Kent.
1888. W. H. A. T. Watson, 65 Eccleston Square, London, W.
1889. T. A. Coward, Eden Town, Carlisle.
1889. *Ash Rudd, East Ruston Hall, Stalham, Norwich.
1889. A. W. Woodburn, 6 Sardinia Terrace, Hillhead, Glasgow.

*** Those marked with an asterisk * are Members of the Royal Agricultural College, Cirencester.**

SYLLABUS OF EXAMINATION

FOR CERTIFICATES AND DIPLOMA.

I.—SCIENCE AND PRACTICE OF AGRICULTURE.

1. Geological strata—surface geology—formation of soils—their classification—chemical and physical characters and composition—suitability for cultivation. 2. The principle of rotations—rotations suitable for different soils—systems of farming. 3. The composition of (*a*) manures—general and special—amounts used per acre—period and mode of application. The composition of (*b*) feeding substances—their suitability for different classes of farm stock—considerations affecting their use. 4. " How crops grow "—our farm crops—their cultivation—diseases—insect injuries and remedies—their chemical composition. The formation and management of plantations. 5. The principles on which drainage, irrigation, and warping operations should be based and carried out. The application of lime—marl—clay, &c. 6. Meteorology, or the laws of climate as affecting plant-life—the influence of light and heat on cultivation—of absorption and retention of heat and moisture—of porosity and capillarity in soils. 7. The breeding, rearing, feeding, and general treatment of farm stock—the different breeds of horses, cattle, sheep, and pigs—their characteristics—the districts where they are generally met with. 8. The machines and implements used in farming—their uses, prices, and the principal points to be attended to in their construction. 9. The " prime movers," or sources of power used in agriculture: man—horse—wind—water—steam—their relative values and advantages. *Text-books*—Morton's 'Cyclopedia of Agriculture,' Blackie & Son; Wallace's 'Farm Live Stock,' Oliver & Boyd; Harris's 'Cheese and Butter Maker's Handbook,' Dunn & Wright; M'Connell's 'Agricultural Note-Book,' Crosby Lockwood & Co.; 'Our Farm Crops,' Blackie & Son; 'How Crops Grow,' Macmillan & Co.; Warington's 'Chemistry of the Farm,' Bradbury, Agnew, & Co.; M'Alpine's 'Grasses'; Geikie's 'Outlines of Geology.'

II.—BOTANY.

1. Nutritive Organs of Plants—root, stem, leaves. Functions of roots. Various kinds of stem, with examples. Use of the stem. Structure of leaves. Different kinds of leaves. Arrangement and functions of leaves. 2. Reproductive Organs—Flower and its parts. Arrangements of the whorls of the flower—calyx, corolla, stamens, pistil. Ovule. Mature pistil or fruit. Pruning and grafting. Seed. Young plant or embryo. Sprouting of the seed, or germination. 3. General Principles of Classification—meaning of the terms Class, Order, Genus, and Species. Illustrations of natural orders taken from plants used in agriculture, such as grain-crops, grasses, clovers, vetches, turnips, mangel-wurzel, peas, beans, &c. Practical examination in fresh specimens and models; some of the latter may be seen in the Museum, at the Royal Botanic Garden, which is open daily to the public, free. *Text-book*—Balfour's 'Elements of Botany,' A. & C. Black, 1876, price 3s. 6d.

III.—CHEMISTRY.

The general principles of chemical combination. The chemistry of the more commonly occurring elements, and their more important compounds. The chemical processes concerned in agriculture generally. The changes which take place in the germination, growth, and maturation of plants, in the weathering and manuring of soils, &c. The composition and chemical character of the common mineral manures. *Text-books*—Roscoe's 'Lessons in Elementary Chemistry,' Macmillan & Co., London, price 4s. 6d.; Johnston and Cameron's 'Elements of Agricultural Chemistry and Geology'; Johnston's 'How Crops Grow,' Macmillan & Co., London; Warington's 'Chemistry of the Farm,' Bradbury, Agnew, & Co., London.

IV.—NATURAL HISTORY.

1. Zoology.

1. The characters distinguishing the primary divisions of the Animal Kingdom. 2. The Orders of the Class Insecta. 3. The principal insects injurious to crops. 4. The animal parasites, external and internal, affecting domestic animals; their life-histories and position in the zoological scale. 5. The Chordate or Vertebrate Type, with its subdivisions. 6. The Orders of Mammalia, with special reference to the domestic and wild mammalia of Great Britain. *Text-book*—Nicholson's 'Introductory Textbook of Zoology,' William Blackwood & Sons, Edinburgh and London.

2. Geology.

7. The various strata forming the earth's crust in their order of deposition. 8. Their influence on the surface soils of the country. 9. The meaning and application of Disintegration, Drift, Alluvium, Dip, Strike, Fault. *Text-books*—Page's 'Introductory Text-Book of Geology' and Lyell's 'Students' Elements of Geology.'

V.—VETERINARY SCIENCE.

1. Anatomy of the digestive organs of horse and ox, describing their structural differences. 2. The process of digestion in the above animals, and food most proper for each in quantity and quality. 3. The management of stock before, at, and after parturition. The time of utero-gestation in the domesticated animals. 4. The general principles to be followed in the treatment of acute and common diseases before assistance of the veterinary surgeon can be procured. *Text-books*—'Youatt on Sheep,' price 7s. 6d.; Steel's 'Diseases of the Ox,' price 15s.; Williams's 'Principles and Practice of Veterinary Surgery,' price 30s.; Williams's 'Principles and Practice of Veterinary Medicine,' price 30s., Maclachlan & Stewart, Edinburgh.

VI.—FIELD ENGINEERING.

1. Land-surveying with the chain. 2. Mensuration of areas of land, in imperial and Scotch acres, from a chain survey or from a plan. 3. Levelling with the ordinary levelling instrument and staff, and calculating levels and gradients. *Text-books*—'Rudimentary Treatise on Land and Engineering Surveying,' by T. Baker, C.E.; 'Weale's Series,' price 2s., part i. chaps. 1, 2, 3, and 6, and part ii. chap. 1, to be read.

VII.—BOOK-KEEPING.

1. Questions in Practice and Proportion. 2. Book-keeping—Describe books to be kept; give examples—taking of stock. *Text-book*—Stephens' 'Practical System of Farm Book-keeping,' William Blackwood & Sons, Edinburgh, price 2s. 6d.

EXAMINATION PAPERS, 1889.

AGRICULTURE.

1. Briefly describe the geological features of the district in which you became familiar with practical Agriculture.

2. Given a 300 acre farm—50 acres of which are in permanent pasture and 250 acres under cultivation—state (1) what rotation of crops you would adopt, and (2) from the estimated amounts of food produced by the crops grown, in addition to a judicious supply of purchased food (amounts in each case to be stated), estimate the numbers of live stock—feeding sheep, cattle or cows, one or all—that you would select as a suitable stock under the circumstances. (You are expected to choose and define the circumstances in accordance with the experience you have had during your training in Agriculture.)

3. Detail the management for a year of a flock of breeding ewes. State what breed you refer to, and the locality in which the flock is kept.

4. Enumerate the principal breeds of cattle in the British Isles, and mention two important distinguishing features in each case.

5. Give a short account of the cultivation of the turnip, from the time of the removal of the previous crop to the period of consumption (include storing for winter and spring use).

6. Specify the kinds and qualities of artificial manure that should be used in economically growing a full crop of turnips on (*a*) light land, and on (*b*) clay land suitable for growing turnips. State the time when the various manures should be applied.

7. What are the advantages of applying lime to land? What amount per acre and at what time may it be safely applied?

8. Explain fully the reasons for the order in which the various crops are placed in the prevailing rotation in your home district.

9. I have within three miles of Edinburgh 10 fat cattle—5 prime polled bullocks, live weight 12 cwt. 2 quarters each, 5 prime Irish heifers, live weight 9 cwt. each—and a butcher has offered me £21 each for the bullocks, £16 each for the heifers. Taking the market price of beef at 8s. per imperial stone, should I sell either or both lots at home, or send them to auction? Give figures in support of your answer.

All to be answered.

(*Three hours allowed.*)

BOTANY.

1 By what modes may pollen be transferred to the stigma (*a*) in Gramineæ, (*b*) in Leguminosæ.

2. Describe the structure of a wheat grain, and contrast it with the seed of a bean.

3. Give the life history of the turnip. Explain the nature of any vegetable parasite which may attack it, and mention the parts directly affected.

4. Name the different species of Lolium, and state how they may most readily be distinguished.

5. Give the distinguishing characters of the cultivated clovers, and their technical names.

(*One and a half hour allowed.*)

CHEMISTRY.

1. What is a Salt? Instance four distinct methods by which salts may be prepared.

2. Explain what is meant by a *soft* and a *hard* water. What are the causes of "temporary hardness" in waters?

3. Enumerate some of the compounds of iron that are found in soils, and explain how it is that some are useful and others injurious.

4. What is the composition of Gypsum? Explain its action as a manure.

5. Green fodders may contain the nitrogenous substances *albumen*, *amides*, and *nitrates*. Define these, and explain how they may be distinguished from each other.

6. When milk is allowed to stand exposed to the air for some time it turns sour. What is the composition of the acid that is formed? How is its formation explained? How may it be extracted from the milk and prepared in a pure state?

(*One and a half hour allowed.*)

NATURAL HISTORY.

GEOLOGY.

1. Explain the terms "mineral," "rock," "formation."

2. Explain the terms "joint," "cleavage," "false bedding," "fault."

3. What is meant by "Denudation," illustrating your meaning by drawing a section through any district in Britain, with the Geology of which you may be acquainted?

4. In what Geological formations would you expect to find the following fossils: Graptolites, Trilobites, Pterichthys, Megalichthys, Lepidodendron, Ichthyosaurus, Euomphalus, Ammonites?

ZOOLOGY.

1. State what you know regarding the structure and metamorphoses of the order Coleoptera, and give three examples of insects belonging to this order which are injurious to cultivated plants.

2. What is the zoological position of the Hessian Fly (*Cecidomya destructor*), and briefly describe its life history and the manner in which it injures grain plants.

3. In what particulars do Birds resemble Reptiles, and in what do they differ from both Reptiles and Mammals?

4. Contrast the dentition of the Ox, Pig, and Dog.

(*One and a half hour allowed.*)

VETERINARY SURGERY.

1. Name the best way of stopping the progress of, and of treating animals affected with a contagious and infectious disease.

2. Describe the diseases of the feet due to bad shoeing.

3. Name the diseases which are liable to be transmitted from Sire or Dam to offspring.

4. Should a horse be fed or watered first? and why?
5. What are the best means of preventing and of treating a "weed."
6. Give the periods of gestation of the Cow, Mare, Sheep, Dog, and Pig.

(*One and a half hour allowed.*)

MENSURATION AND FIELD ENGINEERING.

NOTE.—Candidates must hand in along with this paper the working out of the questions. Answers to the questions, excepting Nos. 4 and 7, are also to be filled in on this paper.

NOTE OF IMPERIAL MEASURE.

10,000 square links = 1 square chain.
625 do. = 0·0625 do. = 1 pole.
25,000 do. = 2·5 do. = 40 do. = 1 rood.
100,000 do. = 10 do. = 160 do. = 4 do. = 1 acre.

The imperial is to the Scotch acre as 1 : 1·261 nearly.

Question No. 1.—Calculate the area of the figure A in imperial acres, roods, and poles, and also in acres and decimals.

Question No. 2.—Calculate the area of the triangular figure B in decimals of an imperial acre.

Question No. 3.—Measure by the scale the figure C, mark the necessary measurements in links on the diagram, and calculate from them the area in imperial acres and decimals.

Question No. 4.—In the figure D, HE is an irregular field boundary. Measure by the scale, and mark in links on the diagram the measurements required in order to survey the boundary HE.

Question No. 5.—Calculate from the measurements the area of the piece of land FHEG, in imperial acres and decimals.

Question No. 6.—The contents of a piece of land being 755 Scotch acres, required the area in imperial acres and decimals.

Question No. 7.—Write down, as if in a level-book, the chaining and staff-readings in feet and decimals shown in sketch section; then reduce the levels beginning at H, so as to calculate the heights of K, L, and M above H; all in feet and decimals.

Question No. 8.—Calculate the gradients between the points H and K, K and L, and L and M.

Answer { Between H and K the gradient is 1 in.
" K and L " " " "
" L and M " " " "

ARITHMETIC AND BOOK-KEEPING.

1. A workman whose wages are 27s. 9d. per week saves 6s. 6d. per week. Find his annual income, expenditure, and savings.

2. A field of 16 acres yields 440 bushels of wheat: how much is that upon every 22 sq. yards?

3. How much Property Tax at 7d. per £1 would be payable in respect of a farm of 912 acres, let at a rent of 27s. 6d. per acre?

4. What would be the rent of 53 acres 1 rood of land at £170, 15s. for 17 acres 3 roods?

5. Lent a man a sum of money, and received back ¼, ⅒, ⅙, and ⅓. Show by vulgar fractions what portion remains unpaid.

6. What is the cost of 5 tons 13 cwt. 3 qrs. 14 lb. of oilcake at £3, 18s. 6d. per ton?

7. If 21¾ bushels of oats seed 9⅔ acres, how many qrs. and bushels will it take to seed 100 acres?

8. Name the different books a farmer ought to keep so as to record accurately his transactions; also their nature and use.

9. The following entries appear in a farmer's memorandum book. To what book or books, and to what account or accounts, would he carry the transactions?—

1889, *March* 13, Edinburgh market-day.
Bought 4 qrs. pease at 34s. 6d. from R. Buchanan—paid cash.
Bought 4 milch cows from J. Gibson, and gave him a bill at 3 months for £84.
Sold 15 qrs. oats at 25s. to James Brownlea.

March 19, Bathgate market-day.
Received from J. Shanks for 5 tons hay sold him last October, £25.
Paid servants' wages to date, £12.
Bought 10 tons manure from R. Gordon at £2, 10s.
Received from James Brownlea for oats sold in Edinburgh last week, £18, 15s.

March 20, Drawn from bank to pay private accounts, £15.

March 22, Received from R. Murdoch for 3 fat cattle sold to him to-day, £60. Paid into bank.

(*One and a half hour allowed.*)

BURSARIES.

REGULATIONS FOR EXAMINATION OF CANDIDATES.

1. The examinations shall be conducted simultaneously about the middle of October at the place where the Show was last held in each Show district (in which there are candidates), on the plan followed in the examinations under the Science and Art Department.

2. A paper shall be set by one of her Majesty's inspectors, assistant inspectors of schools, or other person selected for the purpose—the subjects to be embraced being the ordinary branches of an English education.

3. One or more Directors (failing whom, some other member) of the Society in each district shall superintend the examination, which shall be wholly in writing. They shall require each candidate to make a written declaration that it is his intention to pursue Agriculture as a business.

They shall open and distribute the papers in the presence of the candidates, and duly transmit their answers to the Secretary.

4. In reporting on the result, the examiner shall state the maximum number of marks in each subject, as well as the number gained by each candidate, with the view of the Board of Directors judging whether any candidate has shown a degree of merit entitling him to a bursary.

5. Candidates must be not less than fourteen years of age, and must be qualified by birth or residence in Scotland. The Council will consider each case on its own merits—their decision to be final.

6. In giving notice of intention to compete for a bursary, applicants must state at which of the following places they wish to be examined, —viz., Edinburgh, Aberdeen, Dumfries, Perth, Glasgow, Melrose, Stirling, Inverness.

Those wishing to compete for bursaries must apply for entry certificate to F. N. Menzies, 3 George IV. Bridge, Edinburgh.

EXAMINATION PAPER, 1889.

Section I.

1. Calculate by the shortest method the value of 27 cwt. 3 qr. 17 lb. 8 oz. at £3, 12s. 6d. a cwt.

2. At what price must I buy cattle in order to realise a profit of 12½ per cent when selling them at £13, 10s. a head.

3. In what way does banker's discount differ from true discount? Find the true present value of a bill for £650 due three months hence, with interest at 4½ per cent.

4. What income will be derived from £5000 invested in the Three per cents at 102½?

5. Find the value of $\frac{\frac{2}{3} \text{ of } \frac{9}{16} \text{ of } 4{\cdot}376}{{\cdot}425 \times {\cdot}07325}$.

6. Extract the square root of 897·3628 to 3 places of decimals.

Section II.

1. Write an essay on "Aims in Life." (Not more than half an hour should be occupied with this exercise.)

2. Give a *general* analysis of the following passage, pointing out the dependence of clauses:—

"The old men were spectators of their performances who often raised quarrels among them and set them at strife with one another that by those early discoveries they might see how their several talents lay and without any regard to their quality dispose of them accordingly for the service of the commonwealth."

Parse the words underlined.

3. State briefly the most important points in which the English of Chaucer differs from the English of Shakespeare and of Alfred respectively.

Section III.

1. Explain briefly any *one* of the following:—
   (*a.*) The construction and principle of working of a barometer.
   (*b.*) The principle of the wheel and axle.

(*c.*) The difference between conduction and radiation of heat.
(*d.*) The preparation and properties of ammonia.

2. Give a brief account of the important physical features, the climate, and productions of *one* of the following countries: Germany, Cape Colony, the Argentine Republic.

3. Where are the following places?—state facts about them: Cadiz, Gothenburg, Callao, Nantes, Odessa, Dresden, Ballarat, Merthyr Tydvil.

4. State briefly what you know of the following persons and events: John Hampden, the Seven Years' War, Daniel O'Connell, the different reforms of Parliament in the present century.

VETERINARY DEPARTMENT.

The Society established a Veterinary Department in 1823, but by an arrangement made with the Royal College of Veterinary Surgeons, the Society's examination ceased in 1881. Holders of the Society's Veterinary Certificate are entitled to become Members of the Royal College of Veterinary Surgeons on payment of certain fees, without being required to undergo any further examination. The number of Students who have passed for the Society's Certificate is 1183.

In 1874, the Society resolved to vote annually eight silver medals for Class Competition to each of the two Veterinary Colleges in Edinburgh, and to the one in Glasgow.

FORESTRY DEPARTMENT.

The Society grants FIRST and SECOND CLASS CERTIFICATES in FORESTRY.

BOARD OF EXAMINERS.

1. *Science of Forestry and Practical Management of Woods.*—Dr CLEGHORN of Stravithy, St Andrews; JOHN MACGREGOR, Ladywell, Dunkeld; WILLIAM M'CORQUODALE, Scone Palace, Perth; J. GRANT THOMSON, Grantown, Strathspey.

2. *Elements of Botany.*—Dr CLEGHORN and Professor BAYLEY BALFOUR.

3. *Elements of Chemistry.*—Dr WM. CRAIG and Dr A. P. AITKEN, Edinburgh.

4. *Land and Timber Measuring and Surveying; Mechanics and Construction, as applied to Fencing, Drainage, Bridging, and Road-making.*—A. W. BELFRAGE, C.E., Edinburgh.

5. *Book-keeping and Accounts.*—WM. HOME COOK, C.A., Edinburgh.

Candidates must possess—1, A thorough acquaintance with the theory and practice of Forestry. 2, A general knowledge of the following branches of study, so far as these apply to forestry: The Elements of

Botany; Elementary Chemistry, especially as applied to Atmosphere, Water, Soil, and Vegetation; Land and Timber Measuring and Surveying; Mechanics and Construction, as applied to fencing, draining, bridging, and road-making; Implements of Forestry; Book-keeping and Accounts. The examinations are open to candidates of any age.

The following have obtained First-Class Certificates:—

George Young Wall, M.R.A.C., Durham,	1870
William Baillie, Forester, Whittinghame, East Lothian,	1871
William Robertson, Forester's House, Lauder,	1871
Peter Loney, Marchmont, Duns,	1873
John M. Aitken, Norwood, Lockerbie,	1880
Richard Henderson, Portland Estates Office, Kilmarnock,	1880
A. H. Gibson, Kirkcaldy,	1882
Alex. Inglis, Tyninghame, Prestonkirk,	1882
Peter Reid, Port Ellen, Islay,	1884
John Wilson, St Andrews,	1884
Cecil Henry Hooper, M.R.A.C., Elmleigh, Beckenham,	1886
William Somerville, Lecturer on Forestry, Edinburgh University,	1886
John Bardgett, Sockbridge Mill, Tirril, Penrith,	1887
Wilfred James Fleet, Marchmont, Duns,	1888
Arthur Charles Forbes, Knowefield, Carlisle,	1888

The following have obtained Second-Class Certificates:—

John M'Ewen, Yellow Cottage, Killin,	1880
Thomas Berwick, 56 North Street, St Andrews,	1885
Donald C. Cameron Grant, Southleigh, Murrayfield.	1886

SYLLABUS OF EXAMINATION.

1.—SCIENCE OF FORESTRY AND PRACTICAL MANAGEMENT OF WOODS.

1. Structure, formation, and ripening of Wood. Predisposing causes of decay. 2. Restoration of Wood-lands:—(1) Natural reproduction; (2) Artificial planting. 3. General management of plantations. Cropping by rotation. Trees recommended for different situations. 4. Season and methods of pruning, thinning, and felling. 5. Circumstances unfavourable to the growth of trees. 6. Mechanical appliances for conveying and converting timber. The different implements and tools used in planting, pruning, felling, barking, and working up timber trees, or preparing them for sale. Construction of saw-mills. 7. Qualities and uses of chief indigenous timbers. 8. Management of nurseries. Seed-sowing. 9. Collection of forest produce. 10. Mammals, birds, and insects which are destructive to trees.

Books recommended—'Theory and Practice of Horticulture,' Lindley: 'Arboriculture,' Grigor, 10s. 6d.; 'Sylviculture,' Bagneris, 5s.; 'Coniferæ,' Veitch; 'Injurious Insects,' Ormerod, 3s.

Candidates are also obliged to undergo a Practical Examination in Forestry.

II.—ELEMENTS OF BOTANY.

1. Nutritive Organs of Plants.—Root, stem, leaves. Functions of roots. Various kinds of stems, with examples. Use of the stem. Structure of leaves. Different kinds of leaves. Arrangement and functions of leaves.

2. Reproductive Organs.—Flower and its parts. Arrangement of the whorls of the flower—calyx, corolla, stamens, pistil. Ovule. Mature pistil or fruit. Pruning and grafting. Seed. Young plant or embryo. Sprouting of the seed or germination. 3. General Principles of Classification—Meaning of the terms Class, Order, Genus, Species. Illustrations taken from common forest trees and shrubs. Practical examination on fresh specimens and models. These may be seen in the Museum at the Royal Botanic Garden, which is open to the public. Candidates may consult Professor Balfour's 'Elements of Botany,' A. & C. Black, Edinburgh, 3s. 6d.; Oliver's 'Elementary Lessons in Botany,' London, 4s. 6d.

III.—CHEMISTRY.

Candidates are required to have an elementary knowledge of Chemistry, such as to enable them to classify the most commonly occurring elements and their most familiar compounds, and to describe their chief characters.

They will be examined more particularly on the following subjects:—

Atmosphere.—Its composition and physical properties,—the causes of changes in its temperature and pressure, and the measurement of these changes by means of the thermometer and barometer. The formation of rain and dew. Gases injurious to vegetation.

Water.—The effects of heat upon it; its movements, its solvent properties, the methods of regulating the supply of water by drainage and irrigation. The characteristics of rain water, spring water, and surface water. The relations of water to the growth and health of plants, and to the climatic conditions of a district.

Soil.—The description and classification of soils and their suitability to the growth of different descriptions of timber trees. The composition of soils, with special reference to the constituents on which their fertility depends, or which are the cause of their sterility. The changes produced in the composition of soils by various physical operations, such as drainage, irrigation, mulching, removal of leaves, &c., and by liming, salting, and manuring.

Vegetation.—The influence of temperature, rainfall, altitude, aspect, and shelter, upon the growth of trees. The conditions favourable to germination. The effects of light, heat, and ventilation upon the growth of trees.

Forest Products.—The preparation and chemical characters of charcoal, potashes, tar, and turpentine.

Preservation of Timber.—Creosoting, kyanising, &c.

Books recommended—'First Principles of Agriculture,' Tanner (Macmillan & Co.); 'Physics Primer,' Balfour Stewart; 'Inorganic Chemistry,' by George Wilson (Chambers).

IV.—LAND AND TIMBER, MEASURING AND SURVEYING; MECHANICS AND CONSTRUCTION AS APPLIED TO FENCING, BRIDGING, AND ROAD-MAKING.

1. The Use of the Level and Measuring Chain. Measuring and mapping surface areas. 2. The measurement of solid bodies—as timber, stacked bark, fagots, &c., earthwork. 3. The different modes of fencing and enclosing plantations; their relative advantages, durability, cost of construction, and repairs. 4. The setting out and formation of roads for temporary or permanent use. 5. The construction of bridges over streams and gullies; of gates or other entrances. Strachan's 'Agricultural Tables,' Oliver & Boyd, Edinburgh, price 2s. 6d.; or Horton's Tables.

V.—BOOK-KEEPING AND ACCOUNTS.

1. Questions in Practice and Proportion. 2. Book-keeping—describe books to be kept; give examples. Taking of stock.

EXAMINATION PAPERS, 1888.[1]

FORESTRY AND PRACTICAL MANAGEMENT OF WOODS.

1. What is the best season for planting the different varieties of forest trees of Britain?

2. In forming an extensive plantation, what system of planting and precautions would you adopt to preserve it from damage by gales?

3. Describe the operations known as "foreshortening," "stem-pruning," and "root-pruning." What physiological principles underlie them?

4. What principles guide the forester in securing timber trees with tall straight stems?

5. In what soils and situations as to altitude and exposure do larch plantations thrive best? State the size and age of plants and the mode of planting?

(*Two hours allowed.*)

BOTANY.

1. What is the natural food of plants? Have they power to select substances?

2. What conditions are requisite for germination in seeds? Describe the process in any seed. What means are sometimes used for assisting germination when the integument is hard?

3. When the bark of a tree is wounded, how is the injury repaired?

4. What are the essential characters of Coniferæ? Give the common and botanical names of the British species.

5. Describe the structure of a simple horizontally expanded leaf. What are the chief functions performed by such leaves?

6. Describe the plant given to you—root, stem, leaf, and flower.

(*One and a half hour allowed.*)

CHEMISTRY.

1. What are the constituents of the atmosphere that are essential to the growth of plants, and in what ways are they essential?

2. Explain the beneficial effects of mulching.

3. Name three distinct classes of soil, and enumerate a few trees for which they are especially well adapted.

4. Mention any gaseous emanations that are injurious to plant life, and describe carefully the characteristic symptoms of the injury done by any one of them.

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[1] In 1889 there was no examination, there being no candidates.

5. In what way does the growth of plantations most beneficially affect the value of adjacent agricultural land?

(*One and a half hour allowed.*)

LAND AND TIMBER MEASURING AND SURVEYING; MECHANICS AND CONSTRUCTION AS APPLIED TO FENCING, DRAINAGE, BRIDGING, AND ROAD-MAKING.

1. What is required so as to be certain of the correct adjustment of a spirit-level for accurate sights?

2. Make form of level-book on separate paper, with four sights marked with imaginary lengths and remarks.

3. Make sketch section of same to imaginary scale, marking on total heights from datum with the imaginary lengths from starting-point.

4. Describe the different kinds of fences, and where suitable, keeping expense in view.

5. Draw sketch of best construction for wooden gate.

6. Draw sketch of wooden bridge of 30 feet span over ravine above burn.

7. Describe method of road-making of permanent character of 30 feet width.

(*Two hours allowed.*)

ARITHMETIC AND BOOK-KEEPING.

1. Reduce ⅓ of 6½ yards to the fraction of a mile.

2. Multiply ·4768 by ·0061; divide 14 by ·7854, and reduce $\frac{9}{22}$ to a decimal fraction.

3. If 8 men perform a piece of work in 12⅓ days, in what time will 9 men and 5 boys do the same, if a boy can perform ⅜ of a man's work?

4. Ash saplings after 5 years' growth are worth 1s. 3d., and increase in value 1s. 3d. each year afterwards, each is allowed 4 square yards of ground, and they are cut after 20 years' growth; what will then be the value of 1 acre?

5. Find the expense of turfing a plot of ground, which is 40 yards long and 100 feet wide, with turfs each a yard in length and 1 foot in breadth, the turfs when laid costing 6s. 9d. per hundred.

6. Find the cost of 3768½ articles at £1, 7s. 4½d.

7. What is the rent of 35 acres 3 roods 20 poles of land at £3, 14s. 3d. per acre?

Describe briefly the books a forester ought to keep, and their nature and use.

(*One and a half hour allowed.*)

CHEMICAL DEPARTMENT.

Chemist to the Society—Dr A. P. Aitken, Chemical Laboratory, 8 Clyde Street, Edinburgh.

The object of the Chemical Department is to promote the diffusion of a knowledge of Chemistry as applied to agriculture among the members of the Society, to carry out experiments for that purpose, to assist members who are engaged in making local experiments requiring the direction or services of a chemist, to direct members in regard to the use of manures and feeding stuffs, to assist them to put the purchase of these substances under proper control, and in general to consider all matters coming under the Society's notice in connection with the Chemistry of Agriculture.

MEMBERS' PRIVILEGES IN RESPECT OF ANALYSES.

The fees of the Chemist for analyses made for members of the Society shall be as follows:—

The estimation of *one* ingredient in a manure or feeding stuff, .	5s.
The estimation of *two* or *more* ingredients in do. .	10s.

These charges apply only to analyses made for agricultural purposes, and for the sole and private use of members of the Highland and Agricultural Society who are not engaged in the manufacture or sale of the substances analysed.

If the sample represents a substance bought under a guarantee, and if it is found to be notably deficient, the Chemical Committee shall take cognisance of such deficiency in the same manner as they do in the case of deficient manures and feeding stuffs supplied to members of analytical associations (see page 29), provided that the Society's regulations as regards sampling are carried out, and that the seller's guarantee accompanies the sample.

Also, that valuations of manures, according to the Society's scale of units (see page 39), shall be supplied in all cases in which the cash price asked by the seller accompanies the sample.

The following analyses are made for *five shillings*:—

Simple Nitrogenous Manures—viz., nitrate of soda, sulphate of ammonia, horn dust, dried blood, meat meal, shoddy, soot, &c.

Simple Phosphatic Manures—viz., mineral phosphates, phosphatic guano, basic slag, &c., superphosphate (soluble phosphate only).

Simple Potassic Manures—viz., sulphate of potash, muriate of potash, potashes, &c.

The following analyses are made for *ten shillings*:—

Manures—viz., all compound and mixed manures, *e.g.*, bone meal, dissolved bones, guanos, composts, &c.

Feeding Stuffs—viz., oilcakes, meals, and compounds.

MISCELLANEOUS.

Analysis of water to determine purity, hardness, and fitness for domestic use	£1	0	0
Analysis of agricultural products—hay, grain, ensilage, roots, &c.	1	0	0
Analysis of soil, to determine fertility and recommendation of manurial treatment	2	0	0

Examination of food or viscera for metallic poison . .	£2	0	0
Examination of food or viscera for alkaloid poison . .	2	0	0

Samples should be sent (carriage paid) to Dr A. P. Aitken, 8 Clyde Street, Edinburgh.

INSTRUCTIONS FOR SELECTING SAMPLES FOR ANALYSIS.

MANURES.

Four or more bags should be selected for sampling. Each bag is to be emptied out separately on a clean floor, worked through with the spade, and one spadeful taken out and set aside. The four or more spadefuls thus set aside are to be mixed together until a uniform mixture is obtained. Of this mixture one spadeful is to be taken, spread on paper, and still more thoroughly mixed, any lumps which it may contain being broken down with the hand. Of this mixture two samples of about half a pound each should be taken by the purchaser or his agent, in the presence of the seller or his agent or two witnesses (due notice having been given to the seller of the time and place of sampling), and these samples should be taken as quickly as possible, and put into bottles or tin cases to prevent loss of moisture, and having been labelled, should be sealed by the samplers—one or more samples to be retained by the purchaser, and one to be sent to the chemist for analysis.

FEEDING STUFFS.

Samples of feeding compounds should be taken in a similar manner.

Samples of cake should be taken by selecting three cakes, breaking each across the middle, and from the broken part breaking off a segment across the entire breadth of the cake. The three segments thus obtained should be wrapped up and sealed by the samplers, and sent for analysis as in the case of manures, and three duplicate segments similarly sealed and labelled should be retained by the purchaser.

SOILS.

Dig a little trench about two feet deep, exposing the soil and subsoil. Cut from the side of this trench horizontal scrapings of the soil down to the top of the subsoil. Catch these on a clean board, and collect in this manner about one pound weight of soil taken from the whole surface of the section. Similar scrapings of subsoil immediately below should be taken and preserved separately. Five or six similarly drawn samples should be taken from different parts of the field, and kept separate while being sent to the chemist, that he may examine them individually before mixing in the laboratory.

VEGETABLE PRODUCTS

Turnips, &c., 20 to 30 carefully selected as fair average bulbs.

Hay, straw, ensilage, &c., should be sampled from a thin section cut across the whole stack or silo, and carefully mixed about; about 10 lb. weight is required for analysis.

Grain should be sampled like manures.

DAIRY PRODUCE.

Milk.—Samples of milk from individual cows should be taken direct from the milk-pail. Average samples from a number of cows should be taken immediately after milking. Samples to be tested for adulteration should not be drawn from the bottom or taken from the top of standing milk, but they should be ladled from the vessel after the milk has been thoroughly mixed.

For most purposes a quart bottle of milk is a large enough sample.

Butter and Cheese.—About quarter-pound samples are required.

WATERS.

Samples of water for analysis should not be put into ordinary wine bottles or stoneware jars stopped with corks, as these usually vitiate the samples. Clear glass Winchester quarts with glass stoppers should be used. Cases containing these, chemically cleaned, are forwarded from the laboratory on application.

Well water should be allowed to run for some time before the sample is drawn.

Standing water from cisterns, tanks, ponds, &c., should be sampled by immersing the bottle entirely under the water, and holding it, neck upwards, about four inches below the surface.

Spring or stream water should be sampled in dry weather, by immersion, if possible; but if not deep enough for that purpose, a perfectly clean cup or glass should be used for transferring the water to the bottle.

When the bottle has been filled the stopper should be rinsed in the water before replacing.

Samples should be despatched to the laboratory *immediately* after being taken.

LOCAL ANALYTICAL ASSOCIATIONS.

I. With the view of encouraging, as well as regulating the conduct of, Local Analytical Associations, the Society contributes from its funds towards their expenses a sum not exceeding £250 annually.

II. The amount of such contribution is to each association at the rate of 10s. for each full analysis, and 5s. for each partial analysis[1] of manure or feeding stuff affected, or such proportion thereof as the above annual contribution may permit of. The pecuniary assistance thus offered is subject to the following conditions being complied with to the satisfaction of the Chemical Committee:—

1. That the rules of the association are submitted to and approved of by the Chemical Committee.
2. That it is a condition of participating in the grant that the association make analyses for members of the Highland and Agricultural Society, being farmers and not members of the local association, charging them the cost price to the association, less the amount recovered from the Society.
3. That the association is managed by a committee of practical farmers owning or occupying land in the district.
4. That the analyst employed is of acknowledged standing.
5. That the benefits of the grant apply only to analyses made for farmers, and that these subscribe towards the expenses of the association, subject to the exception in No. 2.
6. That each analysis represents at least one ton of bulk actually purchased and delivered to one or more members under guarantee, or at a specified price per unit of valuable ingredients.
7. That the analysis has been made from a sample drawn after delivery, in accordance with the published instructions of the Society, and that a sealed duplicate sample has been retained.
8. That all analyses are reported according to forms furnished by the Highland and Agricultural Society, and that valuations of manures, if any are made, are calculated on a uniform standard to be issued periodically by the Society, and at least once a-year.

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[1] A partial analysis is one in which only one important constituent has been determined by the chemist or guaranteed by the seller.

III. (*a*) A general report regarding the analyses for which the Society has contributed payment is submitted to the general meeting in January, and full details concerning manures and feeding stuffs whose analyses show any of the valuable constituents to be deficient to the extent of one-tenth of the amount guaranteed, or whose total deficiencies represent as much as one-tenth of the value of the manure or feeding stuff, are published annually in the 'Transactions.'

(*b*) In the case of every analysis showing the deficiency above described, the secretary of the association must obtain confirmation of the deficiency from the chemist. The deficiency having been confirmed, the duplicate sample must be forwarded to the Secretary of the Highland and Agricultural Society. A copy of the analysis must at once be sent to the seller, and any explanations received from him forwarded in due course to the Secretary of the Highland and Agricultural Society.

(*c*) Should the seller be dissatisfied with the results obtained by the analyst of the association, a further analysis may, at his option, be made from the duplicate sample by another analyst to be chosen by the Society, and at its cost if the further analysis exonerates the seller ; if otherwise, at the seller's cost.

IV. The report of each analysis for which a grant is claimed must be sent to the Secretary of the Highland and Agricultural Society on or before the 1st November of each year, written on a schedule issued by the Society, and accompanied by a form of guarantee (also issued by the Society), which must be filled up and signed by the seller.

The schedules and guarantee forms are supplied by the Secretary of the Society on application, and no grant is given for any analysis whose schedule and guarantee form are not accurately filled up.

No grants will be given for analyses whose schedules are sent in later than 1st November.

The actual analytical reports of the association's analyst need not accompany the schedules, but must be forwarded if desired.

METHOD OF PROCEDURE TO BE FOLLOWED BY SECRETARIES AND MEMBERS OF ANALYTICAL ASSOCIATIONS APPLYING FOR GRANTS FROM THE HIGHLAND AND AGRICULTURAL SOCIETY.

1. When a member makes a purchase he must obtain from the seller an analytical guarantee, written and signed by the seller, upon a form supplied by the Society.

2. When the member receives delivery of the stuff bought, he must inform the seller of the time and place at which the samples are to be taken for analysis, so that he may have an opportunity of being present.

3. In sampling a manure or feeding stuff the Society's printed instructions for sampling must be strictly complied with.

4. The sample (if it is to be analysed) must be sent to the chemist within a week of the date of sampling, so that any deficiency may be immediately detected.

5. The chemist must be asked to send in his report of analysis within a fortnight after receiving the sample.

6. When an analysis shows the sample to be deficient to such an extent as to require investigation by the Society, the Association's chemist must be asked to verify the accuracy of his analysis, and report the matter within a week.

7. When a deficiency has been confirmed the Secretary of the Association must immediately inform the seller thereof, and draw his attention to the provisions of Regulation III.

8. At the same time the duplicate sample must be sent to the Secretary

of the Highland and Agricultural Society, and along with it must be sent the schedule relating to the purchase, and also the guarantee form, both accurately filled up in every particular.

9. Any correspondence that may ensue with the seller or buyer must be forwarded to the Secretary of the Highland Society as soon as received, so that the Committee may be able to investigate the matter with full knowledge of all the details.

10. The schedules (accurately filled up) of all samples for which the Association claims a grant, along with the signed guarantees appertaining to them, must be sent to the Secretary of the Highland and Agricultural Society on or before 1st November, or they will not be received.

MANURES—THEIR COMPOSITION AND CHARACTERISTICS.

Nitrate of Soda.—A most valuable nitrogenous manure. Perfectly soluble, and immediately available for the nourishment of the plant. Feebly retained by the soil. Rapidly goes down to the subsoil. When much nitrate of soda is frequently applied and unaccompanied by other manures, it causes the soil to be rapidly exhausted. Benefits deeply-rooting plants.

Good samples contain 95 per cent or upwards of pure nitrate of soda, equivalent to about 19 per cent of ammonia.

Sulphate of Ammonia.—A more concentrated nitrogenous manure than the preceding. Perfectly soluble, but not so rapid in its action as nitrate of soda. It is somewhat firmly retained by the soil, and not so liable as nitrate of soda to be washed out by heavy rains. It is therefore more suitable than nitrate for wet districts.

Good samples contain 95 per cent or more of pure sulphate of ammonia, equivalent to from about 24½ to 25 per cent of ammonia.

Dried Blood.—A nitrogenous manure, which differs from the above in being insoluble. It must be decomposed in the soil before it yields up its nitrogen to the plant, and this it does only slowly. The nitrogen is in the form of albumen, and is capable of yielding from 12 to 16 per cent of ammonia.

Horn Dust—Keronikon.—An insoluble nitrogenous manure, capable of yielding 16 to 18 per cent of ammonia. Its efficacy as a manure increases in proportion as it is finely ground.

Horn, when in the form of chips or coarse shavings, decomposes extremely slowly, and is not suitable for application as a manure.

Shoddy or Wool Waste.—An insoluble nitrogenous material used by manure manufacturers as a source of ammonia in dissolved manures. It is capable of yielding from 5 to 14 per cent of ammonia. It is a useful manure when dissolved, but not otherwise.

Leather.—A very insoluble nitrogenous material, yielding about 9 per cent of ammonia, used by manure manufacturers after being melted and ground, but of little value until it has been dissolved.

Peruvian Guano.—A general manure formed of the excrements of fish-eating birds, and containing nitrogenous compounds, phosphates, and potash.

High-class Peruvian guano is rich in nitrogenous matter, a large proportion of which is soluble. As formerly imported, it was capable of yielding from 8 to 12 per cent ammonia, part of which was derived from ammonia salts, and part (less than 1 per cent) from nitrates. Phosphates were low, seldom exceeding 30 per cent, but from one-quarter to one-half of the phosphates were soluble. The amount of potash was usually from 3 to 5 per cent. Not now imported.

Low-class Peruvian guano, as now imported, is poor in nitrogenous matter, yielding only from 3 to 5 per cent ammonia. The phosphates are correspondingly high, viz., from 30 to 50 per cent, but the proportion of soluble phosphate is much smaller than in high-class Peruvian guano. Potash occurs to a very small extent, viz., about 1 to 3 per cent.

Low-class guanos are formed originally from high-class guanos, by the washing out of soluble constituents by rain, &c., and their composition varies greatly according to the amount of washing they have undergone.

Genuine Peruvian guano frequently contains a large proportion of stony insoluble matter.

Fortified Peruvian Guano,—also called by various names, such as *improved*, *equalised*, &c.—Such guanos are mixtures, with low-class Peruvian guano for a basis. Sulphate of ammonia is added, and perhaps also other nitrogenous matter, to bring them up to the guaranteed analysis, say from 8 to 10 per cent ammonia.

Dissolved Peruvian Guano.—This is usually Peruvian guano dissolved in sulphuric acid, and fortified with sulphate of ammonia so as to make a strong, active manure.

Ichaboe Guano.—A true guano, but of recent formation. It is very rich in nitrogenous matter, which yields from 10 to 16 per cent of ammonia, but a large part of the nitrogenous matter is in the form of feathers, which are insoluble and of low manurial value, otherwise it resembles high-class Peruvian guano. The total phosphates vary from 18 to 30 per cent, of which from a fourth to a half is usually soluble. There is seldom more than 2 per cent potash present.

Fish Guano.—Derived from fish-curing yards, and consisting of the heads and offal of fish, dried and ground. Properly speaking, it is not a guano. The name guano is properly applied only to the dung of birds and some other animals.

High-class fish guano contains nitrogenous matter, yielding from 10 to 12 per cent of ammonia, but it is in the form of insoluble albuminous compounds, which only very slowly decompose and become available as plant food. The phosphates range from 18 to 30 per cent, and are all insoluble.

Low-class fish guanos are substances like the preceding, but containing less nitrogenous matter and more phosphates. They are simply fish-bone manures, with somewhat more ammonia and less phosphate than ordinary bone meal, and having no real resemblance to a guano.

Fish guanos are usually impregnated with fish oil, which detracts from the value of the manure. The oil varies from 3 to 10 per cent.

Frey-Bentos Guano.—The dried and ground residue and débris of animals after the extraction of "Liebig's Extract." It is not a guano. It contains nitrogenous matter and phosphates, both of which are insoluble and slow in their action as manures. It varies very much in composition, yielding from 5 to 14 per cent ammonia, from 5 to 35 per cent phosphates. *Meat meal* is a name given to the kind which contains most ammonia and least phosphate.

Bone Meal.—Chiefly a phosphatic manure, but containing also nitrogenous matter. Phosphates range from 44 to 55 per cent, according to the purity of the bones, and are insoluble. The nitrogenous matter is capable of yielding from 4 to 5 per cent ammonia, and is also insoluble. The higher the phosphates the lower the ammonia, and *vice versa.* The finer ground it is the more speedy is its action.

Bone Dust.—A coarser ground bone than the preceding.

Crushed Bones.—Still coarser ground.

Steamed Bone Flour.—Bones which have been subjected to steam at high pressure for the extraction of glue or gelatine. The residue contains from 56 to 65 per cent phosphates, and from 1 to 2 per cent ammonia. It is white-coloured and friable, and can be crushed with the hand. It is able to be, and ought to be, ground to a fine flour.

Pure Dissolved Bones.—Bones dissolved in sulphuric acid. It contains usually less than 20 per cent soluble phosphate, about 10 to 15 per cent of insoluble phosphate, and yields about 3½ per cent ammonia.

Pure Vitriolated Bones.—Bones which have been moistened with sulphuric acid, and thereafter allowed to heat in large heaps. It contains less soluble phosphate and more ammonia than the preceding, and is usually made from more coarsely ground bones.

Dissolved Bone Manures.—These are compound manures, consisting of any mixture of phosphatic and nitrogenous materials which can be dissolved, with some admixture of bone, so as to produce a manure containing from 15 to 30 per cent soluble phosphates, and from 1 to 3 per cent ammonia. *Dissolved bone manures* frequently contain some bone material that has not been dissolved.

Superphosphates.—Phosphates dissolved with sulphuric acid. Their composition varies according to the richness of the phosphate from which they are made, and the extent to which they have been dissolved. If mixed with nitrate of soda, except in very small quantity, it causes loss from escape of nitrous fumes, which are injurious when breathed.

High-class Superphosphates are made from phosphates containing a high percentage of phosphate of lime, and are very thoroughly dissolved. They should contain between 35 and 40 per cent soluble phosphate.

Low-class Superphosphates usually contain 26 to 28 per cent soluble phosphate.

Mineral Phosphates exist in great variety, and contain very various proportions of phosphate of lime, viz., from 20 to 90 per cent. They are of use as manures only when they are ground to the finest flour.

Thomas-Slag, Basic Cinder, or Slag Phosphate Meal.—A substance obtained as a waste product in the dephosphorising of steel. It contains from 30 to 40 per cent phosphate of lime, and is manufactured into a powder of extreme fineness, 80 per cent at least passing through No. 100 wire-cloth. It is more soluble and available for plant-food than ground mineral phosphates. It may be mixed with nitrate of soda, but *not with sulphate of ammonia.*

Compound Manures.—These are general manures containing nitrogenous matter, phosphates, and potash, and their value depends not only on the amounts of these constituents, but also on their fineness of division, their solubility, and the sources from which their ingredients are derived.

The general character of a few of the more common of these may be indicated thus:—

Turnip Compounds.—These usually contain from 25 to 35 per cent phosphates, of which the half or more is soluble, and nitrogenous matter, capable of yielding from 2 to 5 per cent of ammonia, and sometimes 1 or 2 per cent of potash.

Potato Compounds.—These are somewhat like the preceding, but contain usually less phosphate and a little more ammonia (from 3 to 6 per cent); sometimes they contain no potash, but more frequently about 3 or 4 per cent is present, and in some instances twice as much.

Bean Compounds.—These may contain from 10 to 20 per cent phosphates, nitrogenous matter yielding from 2 to 4 per cent of ammonia, and usually a considerable proportion of potash, often as much as from 10 to 20 per cent.

Cereal Compounds.—These usually contain about 20 per cent phosphates, mostly soluble, and nitrogenous matter, partly as nitrates, yielding from 3 to 8 per cent ammonia, and they may also contain potash.

Grass Compounds.—These are somewhat like the preceding, but may contain less phosphates and more nitrogen, part of which is usually in the form of nitrate.

NOTES REGARDING ANALYSES OF MANURES.

The three ingredients of greatest importance in manures are phosphoric acid, nitrogen, and potash.

1. **Phosphoric Acid** is present in manures as such, and also as phosphates of lime, magnesia, iron, and alumina.

Phosphate of Lime is most important, and exists in two states, insoluble and soluble.

Insoluble—

Insoluble phosphate of lime, called also Tricalcic phosphate, and Tribasic phosphate of lime,	contains about 46 per cent phosphoric acid.

Soluble—

Soluble phosphate of lime, called also Monocalcic phosphate of lime, and *erroneously* Monobasic phosphate of lime,	contains about 61 per cent phosphoric acid.

Some analysts prefer to state the soluble phosphate as

Biphosphate of lime, called also Monobasic phosphate,	contains about 72 per cent phosphoric acid.

The soluble phosphates are usually stated as equivalent to so much tricalcic or insoluble phosphate.

Soluble phosphate, multiplied by	1⅓	gives the equivalent of tricalcic phosphate nearly.
Biphosphate, „ „	1½	

Much confusion has arisen from the various methods of stating soluble phosphate. To escape from this confusion, it has now become the custom to consider the term "soluble phosphate" *to mean* "phosphate of lime rendered soluble." IN OTHER WORDS, SOLUBLE PHOSPHATE MEANS THE INSOLUBLE PHOSPHATE FROM WHICH IT WAS DERIVED.

Phosphate of magnesia occurs in small quantity in bones, &c., and is usually reckoned as tricalcic phosphate.

Phosphates of iron and alumina, when occurring in *small quantity*, are usually reckoned as tricalcic phosphate, but if the quantity is considerable it should be separately estimated.

2. **Nitrogen** occurs in manures mostly in three forms—Ammonia salts, nitrates, and albuminoid matter.

Ammonia sulphate (pure), contains 25¾ per cent ammonia.
Ammonium chloride (pure), „ 31¾ „ „
Nitrate of soda (pure), contains nitrogen equal to 20 per cent ammonia.
Albuminoid matter contains from 14 to 16 per cent nitrogen, equal to from 17 to 19 per cent ammonia, most of which sooner or later becomes available as plant food.

3. **Potash** occurs mostly in the form of soluble salts, and should be reckoned as anhydrous potash (K_2O).

Sulphate of potash (pure), contains potassium = 54 per cent anhydrous potash.
Muriate of potash (pure), contains potassium = fully 63 per cent anhydrous potash.

FEEDING STUFFS—THEIR COMPOSITION AND CHARACTERISTICS.

These are concentrated forms of fodder, whose value depends upon their *albuminoid matter*, *oil*, and *carbohydrates* (such as starch and sugar).

Linseed (seed of *Linum usitatissimum*, Common Flax).—Bombay seed large and pale; Baltic seed smaller and dark brown, more liable to impurities than Bombay seed; should be crushed and plotted before feeding. Useful in calf fodders, also for milk-giving, and in the last stage of masting. Quantity, 1 to 3 lb. per 1000 lbs. L.W.

Linseed-cake.—Much approved feeding cake; merits well known. Home-made cake usually softer and more oily than foreign. Very hard pressed cake should be avoided, as it is low in oil, and not easily digested. Linseed-cakes usually impure. Chief impurities, rape-cake and locust-beans, less frequently chaff, and weed seeds from badly screened seed. Should be broken to small pieces before feeding. Quantity, 2 to 6 lb. per 1000 lbs. L.W.

Rape-cake (seed of *Brassica Napus* and *B. campestris*).—It has a greenish mottled appearance and a bitter taste, which renders it distasteful to cattle at first. Should be given in small quantity to begin with. Not suited for calves. When given to milch cows, the quantity should not exceed 2 or 3 lb. per head per day, or it will give a disagreeable taste to milk and butter. Sometimes very impure. A dangerous impurity is mustard-seed. May be detected by steeping in cold water for some hours, and noting smell of mustard. Danger may be avoided by steeping the ground cake in *boiling* water.

Poppy-cake (seed of *Papaver somniferum*).—Contains a savoury and easily digestible oil. May be fed to cattle in considerable quantity—5 to 8 lb. per head per day. More than 5 lb. per head per day to milch cows detracts from flavour of butter.

Hemp-cake (seed of *Cannabis sativa*).—Not much used for feeding. Not so digestible as the above, owing to abundance of woody fibre (25 per cent). Fed chiefly to horses and sheep. To milch cows not more than 1 lb. per head per day. Apt to grow mouldy in summer.

Sunflower-cake (seed of *Helianthus annuus*).—Relished by stock, and well digested.

Cotton-cake (seed of *Gossypium hirsutum*, &c.) *Undecorticated.*—Best quality from Egyptian and Sea Island seed. Inferior qualities are woolly, and to be avoided. Husk has astringent properties, and is a good cure for *scour*. Should be ground to the size of linseed. Not very digestible, owing to abundance of woody fibre (28 per cent). Should be used freshly made, because liable to mould on keeping.

Decorticated—viz., cotton-cake deprived of the husk.—A very concentrated and powerful bye-fodder. Should be given with caution, crushed fine, and mixed with Indian corn, oats, or other farinaceous food. Large quantity is injurious, and may even be fatal. Very variable in composition. Frequently very hard pressed, and therefore indigestible. When freshly made, softly pressed, and of good quality, it is a valuable bye-fodder. Oil very bland and digestible; used to adulterate olive-oil.

Sesame-cake (seed of *Sesamum orientale*).—Seed imported from India. Excellent bye-fodder, easily digested, much relished by all kinds of stock. Favourable for milk-giving, and also for masting. Oil bland and digestible, and much in favour for making butterine.

Rice-meal (seed of *Oryza sativa*).—The meal is a bye-product obtained in preparing rice for the market. A very good, safe and acceptable fodder, but less concentrated than ordinary oilcakes. Varies very much in quality, and frequently adulterated with meal derived from rice husks. Much relished by stock, and useful for milch cows as well as for fattening animals.

Rye-meal.—Is the bran of rye, and rather more concentrated than wheat bran. It is very good fodder for cattle and sheep, but not for horses.

Palm-kernel Cake.—An excellent, palatable, and easily digested bye-fodder. Especially good for milch cows. Increases the proportion of fat in milk. Puts a finish upon fattening stock. When ground to powder and most of the oil extracted, it is sold as *Palm-kernel meal*, a much relished and digestible bye-fodder. A useful addition to calf-meals.

Flesh-meal.—Residue obtained in the manufacture of *Liebig's Extract of Beef*. A highly nitrogenous bye-fodder, most suitable for enriching a too farinaceous dietary, such as potatoes. Much used in that way as a swine fodder. Easily digested, and readily accepted by cattle.

Fish-meal.—Bye-product of fish-curing yards, made chiefly from the heads of cod and tusk. Resembling fish guano in composition, but somewhat variable. Highly phosphatic, and therefore useful as a bye-fodder to young growing cattle. Ratio, from 1 to 3 lb. per head per day.

Herring-meal.—A very oily fodder, useful as an adjunct to the dietary of milch cows. Quantity, 1 to 6 lb. per head per day.

Locust-beans—*Carob Bean.*—A sugary fodder, most palatable and acceptable to all kinds of stock. Used to mix with oilcakes and meals, so as to improve their flavour.

THE COMPOSITION OF FEEDING STUFFS.

The following is the average composition of genuine cakes and meals in common use:—

	Albuminoids.	Oil.	Carbohydrates.
Linseed-cake	29	11	32
Rape-cake	31	10	30
Poppy-cake	35	10	22
Hemp-cake	30	8½	17
Sunflower-cake	33	9	27
Cotton-cake	28	7½	30
,, (decorticated)	44	15	20
Sesamé-cake	37	13	21
Rice-meal	11	10	50
Paisley meal	15	9	60
Rye-meal	14.5	3.5	60
Bran	13.5	3.5	56
Palm-kernel cake	17	10	41
Palm-kernel meal	19	3½	44
Flesh-meal	71	13	...
Fish-meal	50	4	...
Herring-meal	40	20	...
Locust-bean meal	4	2	74
Linseed	21	37	20

USEFUL FACTORS.

Amount of	Multiplied by	Gives corresponding amount of
Nitrogen	1.214	Ammonia.
"	6.3	Albuminoid matter.
Ammonia	3.882	Sulphate of ammonia.
"	3.147	Muriate of ammonia.
"	3.706	Nitric acid.
"	5.0	Nitrate of soda.
Potash (anhydrous) . .	1.85	Sulphate of potash.
"	1.585	Muriate of potash.
Phosphoric acid (anhydrous) .	2.183	[1] Phosphate of lime.
" "	1.4	Biphosphate.
" "	1.648	Soluble phosphate (monocalcic tribasic).
Soluble phosphate[2] . .	1.325	Phosphate of lime.
Biphosphate	1.566	"
Lime	1.845	"
"	1.786	Carbonate of lime.

The following are the forms in which analyses of *ordinary genuine* manures and feeding stuffs are usually reported:—

I. REPORTS OF ANALYSES OF *MANURES.*

(On the left side are the analytical details which may vary in form, and on the right the valuable constituents which must not vary in form, and which alone are considered in estimating the value of manure.

1. Form of Analysis for SUPERPHOSPHATES, DISSOLVED BONES, and the like.

	Capable of yielding as valuable constituents.
Phosphoric acid, soluble	Phosphates of lime dissolved . } ......
Do., in an insoluble state......	Do. do. undissolved . }
Lime . . . . . }	
Sulphuric acid, organic matter, &c. . . }	
Sand and insoluble matter......	Ammonia . . . .

2. Form of Analysis for BONES, BONE-MEAL, FISH-GUANO, and the like.

	Capable of yielding as valuable constituents.
Phosphoric acid	Phosphate of lime . . . .
Lime	
Alkalies, &c.	
Organic matter	Ammonia . . . .
Moisture	
Sand and insoluble matter......	

---

[1] By phosphate of lime is meant tricalcic phosphate ($3CaO, P_2O_5$).
[2] Monocalcic tribasic phosphate ($CaO, 2H_2C, P_2O_5$).

3. Form of Analysis for MIXED MANURES, PERUVIAN and ICHABOE GUANOS, and the like.

	Capable of yielding as valuable constituents.
Phosphoric acid, soluble	Phosphate of lime dissolved } ......
Do., in an insoluble state	Do. do. undissolved }
Lime	
Alkalies, &c.	Potash . . . .
Organic and volatile matter	Total nitrogen, = ammonia . . ..
Moisture	
Sand and insoluble matter......	

II. REPORTS OF ANALYSES OF *FEEDING STUFFS.*

Valuable Constituents	Albuminoid compounds	......	= Nitrogen ......
	Oil	......	
	Carbohydrates . .	......	
	Woody fibre . . .	......	
	Moisture . . .	......	
	Ash	......	

FORMS OF GUARANTEE.

GUARANTEE OF MANURE.

I guarantee that the manure called......................and sold by me to ....contains a minimum of—

Soluble phosphoric acid = Phosphate of lime dissolved............per cent.
Insoluble phosphoric acid = Phosphate of lime undissolved.........per cent.
Potash salts . . = Potash (K_2O) . . . .per cent.
Total nitrogen . . = Ammonia . . . .per cent.

Signature of seller........................

Date..................18...

GUARANTEE OF FEEDING STUFF.

I guarantee that the feeding stuff called...............and sold by me to ....contains a minimum of—

.... per cent albuminoids.
.... per cent oil.
.... per cent carbohydrates.

Signature of seller........................

Date..................18...

LOCAL ANALYTICAL ASSOCIATIONS WHO HAVE RECEIVED THE SOCIETY'S GRANTS.

	County.	Name of Association.	Name and Address of Secretary.	Number of Analyses.				Grants obtained.			
				1886.	1887.	1888.	1889.	1886.	1887.	1888.	1889.
1	Aberdeen . .	Alford Analytical Association .	C. M'Connach, Cairnballoch, Alford	11	15	12	19	£5 10 0	£6 15 0	£5 5 0	£8 5 0
2	" . .	Buchan Farmers' Analytical Association	Thomas Forrest, Mains of Ludquharn, Longside	12	10	16	10	5 10 0	4 10 0	7 5 0	4 10 0
3	" . .	Turriff Analytical Association .	Leslie Durno, Mains of Glack, Old Meldrum	32	23	26	32	13 15 0	10 15 0	10 15 0	15 0 0
4	Ayr . . .	Galston and Loudoun Farmers' Analytical Association	Alexander Goldie, Darvel . . .	..	..	4	4	..	2 0 0	2 0 0	2 0 0
5	" . . .	Grougar Farmers' Analytical Assoc.	R. Whyte, East Raws, Kilmarnock .	5	4	4	3	2 5 0	1 10 0	1 10 0	1 0 0
6	Argyll . . .	Kintyre Farmers' Analytical Assoc.	R. Dickie, Kileonan, Campbeltown .	..	4	5	7	..	1 5 0	1 10 0	2 5 0
7	Caithness . .	Caithness Farmers' Analytical Asso.	G. Brown, Watten Mains, Caithness	31	..	..	..	14 0 0	..	..	..
8	Dumfries . .	Annandale Farmers' Club . .	J. & J. Baird and J. Mackenzie, Lockerbie	26	..	..	5	11 5 0	..	..	1 15 0
9	Elgin . . .	Morayshire Analytical Assoc. .	R. Barclay Gordon, 78 High St., Elgin	..	..	..	10	..	..	..	4 10 0
10	Forfar . . .	Arbroath Analytical Association .	James Kydd, Scryne, Carnoustie .	17	19	8	25	6 5 0	8 10 0	3 15 0	9 0 0
11	" . . .	Carse of Gowrie Farmers' Analytical Association	A. Anderson, Berryhill, Dundee .	14	12	..	10	6 0 0	5 5 9	..	4 0 0
12	" . . .	Kirriemuir Analytical Association	Andrew Osler, Kintyrie, Kirriemuir	..	..	12	..	..	..	5 5 0	..
13	Inverness . .	Inverness Farmers' Society . .	William Ross, Seafield of Raigmore, Inverness	7	..	..	..	3 0 0	..	..	..
14	Kincardine . .	Kincardineshire Farmers' Club .	A. B. Annandale, Stonehaven . .	5	..	..	..	1 15 0	..	..	..
15	Kirkcudbright .	Kirkcudbright Analytical Association	R. Sproat, Lennox Plunton, Kirkcudbright	21	15	15	21	9 5 0	6 5 0	7 0 0	9 15 0
16	Lanark . . .	Lanarkshire Analytical Association	J. Lindsay, Eastfield, Thankerton .	20	20	16	15	8 0 0	7 15 0	6 15 0	6 0 0
17	" . . .	Avondale Farmers' Analytical Asso.	John Paterson, Torfoot, Strathaven .	5	7	7	..	2 0 0	2 15 0	2 10 0	..
18	Nairn . . .	Nairnshire Analytical Association	J. S. Robertson, Cawdor Estate Office, Nairn	..	..	..	16	..	..	..	6 15 0
19	Orkney . . .	Orkney Agricultural Society .	Jas. Johnston, Orphir House, Orphir	..	..	..	..	..	..	..	..
20	Perth . . .	Strathearn Analytical Association	Robt. Gardiner, Henhill, Auchterarder	..	23	12	12	..	9 10 0	5 10 0	5 10 0
21	Ross . . .	Easter Ross Analytical Association	John Gordon, Balmuchy, Fearn .	14	9	..	23	4 15 0	2 15 0	..	8 15 0
22	" . . .	Wester Ross Analytical Assoc. .	Walter Arras, Fodderty Lodge, Dingwall	6	19	29	32	2 15 0	8 0 0	11 0 0	12 10 0
23	Roxburgh . .	Kelso Analytical Association .	Alex. Pott Stevenson, Kelso . .	..	36	18	12	..	14 15 0	7 15 0	4 15 0
24	Wigtown . .	Stoneykirk Analytical Association	James Hunter, Culgroat, Stranraer .	..	..	..	4	..	..	..	1 10 0
				226	216	184	257	96 0 0	92 5 0	77 15 0	107 15 0

UNITS TO BE USED IN DETERMINING THE COMMERCIAL VALUE OF MANURES.[1]

Terms—CASH, including Bags gross weight—not including Carriage.

N.B.—These units are based on the present MARKET PRICES at port. When these units are multiplied by the percentages in the analysis of a Manure, they will produce a value representing very nearly the cash price at which one SINGLE TON may be bought in fine sowable condition. Larger purchases may be made on more favourable terms.

For Season 1890.

Items to be Valued.	Ichaboe Guano.	Peruvian Guano (Riddled).	Fish Guano.	Frey-Bentos Guano.	Bones.			Steamed Bone Flour.	Dissolved or Vitriolated Bones.	Superphosphates.	Dissolved Compounds.		
Classes		Genuine.			*a.*	*b.*	*c.*	*a.*			From	To	Average.
Phosphates dissolved	..	..	..	..	..	..	..	..	3/3	2/6	2/6	3/3	2/10
Phosphates undissolved	2/6	2/2	1/9	1/8	1/10	1/9	1/8	1/9	1/9	..	1/6	2/3	1/9
Ammonia . .	17/6	16/-	12/-	13/-	12/-	11/6	11/-	12/-	13/-	..	12/-	17/-	13/-
Potash . . .	..	3/6	..	..	..	..	..	..	..	..	3/6	4/-	4/-

CLASSIFICATION OF MANURES.

Frey-Bentos and Fish-guanos	Frey-Bentos, also called "Liebig's Meat Guano," varies much in composition. Fish-guano usually contains from 10 to 20 per cent of phosphate, and from 7 to 12 per cent of ammonia.
Bones	(*a*) 90 per cent passing ⅛-inch sieve. (*b*) 90 per cent passing ¼-inch sieve. (*c*) Coarser. Genuine bone-meal contains from 45 per cent to 55 per cent phosphates, and from 4 per cent to 5 per cent ammonia. If phosphates are high ammonia is correspondingly low, and *vice versa.*
Steamed bone-flour . .	Bones degelatinised and ground to flour containing about 60 per cent phosphates, and about 2 per cent ammonia.
Pure vitriolated bones .	Containing nothing but natural bones and sulphuric acid.
Dissolved Compounds .	Including dissolved-bone manures and all special manures consisting of ingredients mixed together and *dissolved as a whole.* The "Average" units should be used in valuing ordinary well-made dissolved compounds. If the manure is of superior manufacture and of high concentration, the units used should be above the average; if of inferior manufacture, or of low concentration, the units used should be below average. In valuing such manures for Associations, the units employed must be specified.
Mixtures . . .	To be valued according to the unit values (as given above) of the ingredients of which they are guaranteed *and also found* to be composed, with an addition of from 5 to 10 per cent, according to the fineness of their manufacture.

Local Analytical Associations receiving grants from the Society must not use other units than these in valuing manures.

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[1] See note, p. 42.

CASH PRICES (February).

Manures.	Guarantee.	Price per Ton.	Unit.
	Per cent.	£ s. d.	
Sulphate of ammonia, 97 per cent	24 Am.	13 0 0	Am. =10/10
Nitrate of soda, 95 per cent	19 "	9 10 0	" =10/
Meat-meal	"	0 0 0	" =14/9
Castor-cake dust	5.5 "	4 5 0	" =15/6
Rape-cake dust	5 "	4 15 0	" =19/
Horn-dust	14 "	9 0 0	" =13/
Dried blood	15 "	9 10 0	" =13/
Muriate of potash, 80 per cent	50 Pot.	8 10 0	Pot. = 8/5
Sulphate of potash, 50 per cent	27 "	5 10 0	" = 4/
Kainit	12 "	2 7 6	" = 4/
Nitrate of potash, 73 per cent	14 "	14 12 6	Am. =12/6
	40 "		Pot. = 4/
Ground Charleston phos.	54 Phos.	4 18 6	Phos. =1/1
Belgian phosphate	54 "	3 0 0	" = 1/1
Thomas-slag (fine)	37 "	2 0 0	" = 1/1

Feeding Stuffs.	Analysis.			Price per Ton.
	Album.	Oil.	Carbo-hydrates.	
				£ s. d.
Linseed-cake	28	10	35	8 10 6
Decorticated cotton-cake	45	8	20	7 0 0
Undecorticated do.	24	7	25	5 0 0
Hemp-cake (broken)	28	9	17	4 15 0
Rape-cake	32	10	27	6 0 0
Bean-meal	25	2	50	7 10 0
Rice-meal	12	12	46	0 0 0
Locust-bean meal	6	2	70	5 15 0
Rye-meal	13.5	3	63	0 0 0
Indian corn	10	5	55	5 5 0
Paisley meal	15	9	60	4 15 0
Linseed (whole)	20	35	14	12 0 0
Linseed-oil	..	..	..	19 10 0
Molasses	..	..	..	6 0 0

INSTRUCTIONS FOR VALUING MANURES.

The commercial values of manures are determined by means of the Units in the following manner:—

Take the analysis of the manure, and look for the following substances:—

Phosphates dissolved (or soluble phosphate)
„ undissolved (or insoluble „)
Ammonia . . . .
Potash . . . .
} No other items but these are to be valued.

Should the analysis or the guarantee not be expressed in that way, the chemist or the seller should be asked to state the quantities in these terms.

Suppose the manure is bone-meal:—

There are three classes of bones, according to their fineness. An ordinary bone-meal will fall under Class (*b*), and it will contain about 50 per cent phosphate, and 4½ per cent ammonia. The units for bones, Class (*b*), are 1s. 9d. for insoluble phosphate, and 11s. 6d. for ammonia. Therefore the value is—

Insol. phosphate,	50 times	1s. 9d.,	equal to	£4	7	6
Ammonia,	4½ „	11s. 6d.	„	2	11	6
			Say	£7	0	0 per ton.

Suppose the manure is dissolved or vitriolated bones:—

It must be guaranteed "pure."

The units in the Schedule are 3s. 3d. for soluble phosphate, 1s. 9d. for insoluble phosphate, and 13s. for ammonia.

The analysis will be about 15 per cent soluble phosphate, 20 per cent insoluble phosphate, and 3 per cent ammonia. In that case the value would be—

Sol. phosphate,	15 times	3s. 3d.,	equal to	£2	8	9
Insol. „	20 „	1s. 9d.	„	1	15	0
Ammonia,	3 „	13s.	„	1	19	0
			Say	£6	2	0 per ton.

Suppose the manure is a superphosphate,—say an ordinary superphosphate, with 27 per cent soluble phosphate and 3 per cent insoluble phosphate. It is valued thus—

Sol. phosphate, 27 times 2s. 6d., equal to, say, £3 7 6 per ton.

Insoluble phosphate is not valued in a superphosphate.

Suppose the manure is a dissolved compound, such as *dissolved bone manures*, or a special manure, such as a *turnip or potato manure*, it will be valued according to the units under "Dissolved Compounds," the *average* units for which are 2s. 10d. for soluble phosphate, 1s. 9d. for insoluble phosphate, 13s. for ammonia, and 4s. for potash, in the Schedule. Thus, an ordinary turnip manure containing 20 per cent soluble phosphate, 10 per cent insoluble phosphate, 4 per cent ammonia, and 2 per cent potash, would be valued thus—

Sol. phosphate,	20 times	2s. 10d.,	equal to	£2	16	10
Insol. do.,	10 „	1s. 9d.,	„	0	17	6
Ammonia,	4 „	13s.	„	2	12	0
Potash,	2 „	4s.	„	0	8	0
			Say	£6	14	0 per ton.

Note.—The units have reference solely to the COMMERCIAL VALUES of Manures, and not to their AGRICULTURAL VALUES.

Thus, in stating soluble phosphate in dissolved bones at 3s. 3d. per unit, and that in superphosphate at 2s. 6d., it is meant that these are the prices per unit at which soluble phosphate can be bought in these two manures; but it does not mean that the soluble phosphate in the one is 9d. per unit better as a manure than that in the other. It is probably no better.

BOTANICAL DEPARTMENT.

Consulting Botanist to the Society—A. N. M'ALPINE, Minto House, Chambers Street, Edinburgh.

The Society have fixed the following rates of charge for the examination of plants and seeds for the *bona fide* and individual use and information of members of the Society (not being seedsmen), who are particularly requested, when applying to the Consulting Botanist, to mention the kind of examination they require, and to quote its number in the subjoined schedule. The charge for examination must be paid at the time of application, and the carriage of all parcels must be prepaid.

Scale of Charges.

1. A report on the purity, amount, and nature of foreign materials, 2s.
2. On the germinating power of a sample of seed, 2s.
3. Determination of the species of any weed or other plant, or of any vegetable parasite, with a report on its habits and the means for its extermination or prevention, 5s.
4. Report on any disease affecting farm crops, 5s.
5. Determination of the species of any natural grass or fodder plant, with a report on its habits and pasture or feeding value, 1s.

The Consulting Botanist's Reports are furnished to enable members—purchasers of seeds and corn for agricultural purposes—to test the value of what they buy, and are not to be used or made available for advertising or trade purposes by seedsmen or otherwise.

Instructions for Selecting and Sending Samples.

In sending seed or corn for examination, the utmost care must be taken to secure a fair and honest sample. In the case of grass seeds, the sample would be drawn from the centre of the sack or bag, and in all cases from the bulk delivered to the purchaser. If anything supposed to be injurious or useless exists in the corn or seed selected, samples should also be sent.

When possible, at least one ounce of grass and other small seeds should be sent, and two ounces of cereals or larger seeds. The exact name under which the seed has been bought (but preferably, a copy of the invoice) should accompany the sample.

Grass seeds should be sent at least four weeks, and clover seeds two weeks before they are to be used.

In collecting specimens of plants, the whole plant should be taken up and the earth shaken from the roots. If possible, the plants must be in flower or fruit. They should be packed in a light box, or in a firm paper parcel.

Specimens of diseased plants or of parasites should be forwarded as fresh as possible. Place them in a bottle, or pack them in tinfoil or oil-silk.

All specimens should be accompanied with a letter specifying the nature of the information required, and stating any local circumstances (soil, situation, &c.) which, in the opinion of the sender, would be likely to throw light on the inquiry.

It is strongly recommended that members purchasing seeds should insist—

(1) Upon having from the seller a guarantee stating the purity and germination of the seed supplied.

(2) That the bulk be same as sample.

(3) That it contain not more than 5 per cent other than the species ordered.

If the purity and germination of the seed is not known, it is impossible to tell either its money value, or the proper amount to be sown.

It is also strongly recommended that the purchase of prepared mixtures should be avoided, and the different seeds to be used should be purchased separately.

Parcels or letters containing seeds or plants for examination (carriage or postage paid) must be addressed to Professor M'Alpine, Botanical Laboratory, Minto House, Chambers Street, Edinburgh.

Grant for grass experiments in 1889, £30.

DAIRY DEPARTMENT.

The Society established in 1885 a Dairy Department, to promote the dairy interests.

During 1885, 1886, 1887, 1888, and 1889, the Society placed at the disposal of the Committee a sum of £100 to aid local efforts in the employment of itinerating Instructors and Demonstrators in Cheese and Butter making.

The grants have been appropriated among the different branches of the Scottish Dairy Associations as follows :—

Branch.	1886.	1887.	1888.	1889.
Ayrshire	£42 17 6	£45 0 0	£37 0 0	...
Wigtownshire, Rhinns District	21 6 6	22 10 0	31 0 0	...
Wigtownshire, Lower District	6 15 0	...		...
Kirkcudbright . . .	10 10 0	10 0 0	22 0 0	...
Dumfriesshire . . .	8 17 0	10 0 0	10 0 0	...
Upper Ward of Lanarkshire .	7 4 0	10 0 0	...	...
Argyleshire	2 10 0	2 10 0	...	...
Kilmarnock Dairy School .	...	...	...	£100 0 0
	£100 0 0	£100 0 0	£100 0 0	£100 0 0

PREMIUMS.

GENERAL REGULATIONS FOR COMPETITORS.

1. It is to be distinctly understood that the Society is not responsible for the views, statements, or opinions of any of the writers whose papers are published in the 'Transactions.'

2. All reports must be legibly written, and on one side of the paper only; they must specify the number and subject of the Premium for which they are in competition; they must bear a distinguishing motto, and be accompanied by a sealed letter, similarly marked, containing the name and address of the Reporter—initials must not be used.

3. No sealed letter, unless belonging to a report found entitled to at least one-half of the Premium offered, will be opened without the author's consent.

4. Reports for which a Premium, or one-half of it, has been awarded, become the property of the Society, and cannot be published in whole or in part, nor circulated in any manner, without the consent of the Directors. All other papers will be returned to the authors if applied for within twelve months.

5. When a report is unsatisfactory, the Society is not bound to award the whole or any part of a Premium.

6. All reports must be of a practical character, containing the results of the writer's own observation or experiment, and the special conditions attached to each Premium must be strictly fulfilled. General essays, and papers compiled from books, will not be rewarded. Weights and measurements must be indicated by the Imperial standards.

7. The Directors, before awarding a Premium, shall have power to require the writer of any report to verify the statements made in it.

8. The decisions of the Board of Directors are final and conclusive as to all Premiums, whether for Reports or at General or District Shows; and it shall not be competent to raise any question or appeal touching such decisions before any other tribunal.

9. The Directors will welcome papers from any Contributor on any suitable subject not included in the Premium List; and if the topic and the treatment of it are both approved, the writer will be remunerated, and his paper published.

CLASS I.

REPORTS.

SECTION 1.—THE SCIENCE AND PRACTICE OF AGRICULTURE.

FOR APPROVED REPORTS.

1. On the results of experiments for fixing and retaining the volatile and soluble ingredients in Farmyard Manure—Twenty Sovereigns. To be lodged by 1st November in any year.

The Report must detail the treatment adopted to fix and retain these ingredients—the materials used for that purpose, and the quantity and cost thereof—comparative analyses of the manure with and without the treatment, and also a statement of the crops grown with manure and without such treatment, must be given by the Reporter. The experiments to have extended over at least two years and crops.

2. On the results of experiments for ascertaining the comparative value of Farmyard Manure obtained from cattle fed upon different varieties of food, by the application of such manure to farm crops—Twenty Sovereigns. To be lodged by 1st November in any year.

The Report must state the effects produced on two successive crops by the application of manure obtained from cattle fed on different sorts of food, such as turnips and straw alone ; and turnips and straw, with an addition of oilcake, linseed, bean-meal, grain, or other substances. The animals should be as nearly as possible of the same age, weight, condition, and maturity, and each lot should receive daily the same quantity of litter; and, except as to the difference of food, they must be treated alike.

The preparation of the manure, by fermentation or otherwise, should be in every respect the same; and it is desirable that not less than two several experiments be made with each kind, and that the ground to which it is to be applied be as equal as possible in quality and condition.

3. On a practical and reliable method of adjusting Farm Rents, in accordance with fluctuations in the prices of Farm Produce. Premium—Fifteen Sovereigns. Reports to be lodged by 1st November 1890.

The object of the paper is to afford those landowners and tenants desiring to adopt the principle of "produce rents," reliable data upon which to base their calculations and carry the system into practice. The writer to set forth the advantages and disadvantages of the system of "produce rents."

4. On the best system of Farm Account Books—Ten Sovereigns. To be lodged by 1st November 1890.

The Report must embrace, 1st, A complete system of account books for a large mixed husbandry farm, including day book, labour account, crop and stock account, cash book, ledger, and form of balance sheet—with convenient provision for recording the labouring, manuring, and produce or stocking of each individual field. 2d, A more concise and simple system of accounts which might suffice for smaller holdings, or for farmers who will not take the trouble to keep a more elaborate series of books.

Example pages and entries to be given with brief description of the working of the system.

5. On the profitable Breeding, Rearing, and Feeding of Pigs on farms and small holdings in Scotland. Premium—Ten Sovereigns. Reports to be lodged by 1st November 1890.

The writer to give information as to the characteristics of the various breeds of pigs suited for Scotland; and describe fully how the pigs should be housed, fed, and treated generally.

6. On the profitable Raising of Poultry on farms, &c., in Scotland. Premium—Ten Sovereigns. Reports to be lodged by 1st November 1890.

The writer to describe the characteristics of the varieties of fowls adapted for the different parts of the country, for table use and egg production; describe in detail the best methods of hatching, feeding, housing, and general treatment of fowls of all ages, in the different seasons—keeping in view the production of eggs all the year round, or when they are worth most money; give information as to the erection of houses and runs for the fowls, with sketches if convenient; and mention the more common ailments of poultry, with instructions as to their treatment.

7. On the hardy and useful Herbaceous Plants of any country, where such climate exists as to induce the belief that the plants may be beneficially introduced into the cultivation of Scotland—The Gold Medal, or Ten Sovereigns. To be lodged by 1st November in any year.

Attention is particularly directed to the grains and grasses of China, Japan, the Islands of the Eastern Archipelago, the Himalaya country, the Falkland and South Sea Islands, California, and the high north-western district of America.

Reporters are required to give the generic and specific names of the plants treated of, with the authority for the same—together with the native names, so far as known; and to state the elevation of the locality and nature of the soil in which they are cultivated, or which they naturally inhabit, with their qualities or uses; and it is further requested that the descriptions be accompanied, in so far as possible, with specimens of the plants, and their fruit, seed, and other products.

8. On the comparative advantages of fattening Cattle in stalls, courts, or covered yards—Twenty Sovereigns. To be lodged by 1st November in any year.

The Report must detail the comparative result of actual experiments. The same quantities and kinds of food must be used. Information is required as to the comparative expense of attendance, the cost of erecting the buildings, and any other circumstances deserving of attention. The state of the weather during the experiment, in point of temperature and wetness, and the advantages or disadvantages of clipping cattle put up to feed, must be particularly noted and reported.

9. On experiments for ascertaining the actual addition of weight to growing or fattening Stock, by the use of different kinds of food — Twenty Sovereigns. To be lodged by 1st November in any year.

The attention of the Experimenter is directed to turnips, carrots, beet, mangel-wurzel, potatoes, cabbage, as well as to beans, oats, barley, Indian corn, linseed, oilcake or rape-cake, and to the effect of warmth and proper ventilation, and the difference between food cooked and raw. The above roots and other kinds of food are merely suggested; competitors are neither restricted to them nor obliged to experiment on all of them.

When experiments are made with linseed and cake, attention should be paid to the comparative advantages, economically and otherwise, of the substance in these two states.

Before commencing the comparative experiments, the animals must be fed alike for some time previously.

The progress of different breeds may be compared. This will form an interesting experiment of itself, for Reports of which encouragement will be given.

N.B.—The experiments specified in the two previous subjects must be conducted over a period of not less than three months. No lot shall consist of fewer than four Cattle or ten Sheep. The animals selected should be of the same age, sex, and breed, and, as nearly as possible, of the same weight, condition, and maturity. The live weight before and after the experiment must be stated, and if killed, their dead weight and quantity of tallow.

10. On Dairy Management, giving the most approved systems of Butter and Cheese Making, the use of the Thermometer, and the best Dairy Utensils—Ten Sovereigns. To be lodged by 1st November 1890.

The Report must be thoroughly practical, and embrace the writer's own experience of butter and cheese making.

11. On the Comparative Feeding Value of Ensilage alone or with other ordinary Farm produce—Fifteen Sovereigns. To be lodged by 1st February 1891.

The Report must detail the comparative result of actual experiments; and the same quantities and kinds of food must be used.

12. On Pasture Plants, indigenous or naturalised—The Gold Medal, or Ten Sovereigns. To be lodged by 1st November 1890.

The writer to give the results of his experience regarding the suitability of pasture plants for cultivation on various classes of land, and in different conditions of situation and climate.

13. On any useful practice in Rural Economy adopted in other countries, and susceptible of being introduced with advantage into Scotland—The Gold Medal. To be lodged by 1st November in any year.

The purposes chiefly contemplated by the offer of this premium is to induce travellers to notice and record such particular practices as may seem calculated to benefit Scotland. The Report to be founded on personal observation.

SECTION 2.—ESTATE IMPROVEMENTS.

FOR APPROVED REPORTS.

1. By the Proprietor in Scotland who shall have executed the most judicious, successful, and extensive Improvement—The Gold Medal, or Ten Sovereigns. To be lodged by 1st November in any year.

Should the successful Report be written for the Proprietor by his resident factor or farm manager, a Minor Gold Medal will be awarded to the writer in addition to the Gold Medal to the Proprietor.

The merits of the Report will not be determined so much by the mere extent of the improvements, as by their character and relation to the size of the property. The improvements may comprise reclaiming, draining, enclosing, planting, road-making, building, and all other operations proper to landed estates. The period within which the operations may have been conducted is not limited, except that it must not exceed the term of the Reporter's proprietorship.

2. By the Proprietor in Scotland who shall have erected on his estate the most improved Farm-buildings—The Gold Medal. Reports, Plans, and Specifications to be lodged by 1st November in any year.

3. By the Proprietor or Tenant in Scotland who shall have reclaimed within the ten preceding years not less than forty acres of Waste Land—The Gold Medal, or Ten Sovereigns. To be lodged by 1st November in any year.

4. By the Tenant in Scotland who shall have reclaimed within the ten preceding years not less than twenty acres of Waste Land—The Gold Medal, or Ten Sovereigns. To be lodged by 1st November in any year.

5. By the Tenant in Scotland who shall have reclaimed not less than ten acres within a similar period—The Medium Gold Medal, or Five Sovereigns. To be lodged by 1st November in any year.

The Reports in competition for Nos. 3, 4, and 5 may comprehend such general observations on the improvement of waste lands as the writer's experience may lead him to make, but must refer especially to the lands reclaimed—to the nature of the soil—the previous state and probable value of the subject—the obstacles opposed to its improvement—the details of the various operations—the mode of cultivation adopted—and the produce and value of the crops produced. As the required extent cannot be made up of different patches of land, the improvement must have relation to one subject; it must be of profitable character, and a rotation of crops must have been concluded before the date of the Report. *A detailed statement of the expenditure and return* and a certified measurement of the ground are requisite.

6. By the Proprietor or Tenant in Scotland who shall have improved within the ten preceding years the Pasturage of not less than thirty acres, by means of top-dressing, draining, or otherwise, without tillage, in situations where tillage may be inexpedient—The Gold Medal, or Ten Sovereigns. To be lodged by 1st November in any year.

7. By the Tenant in Scotland who shall have improved not less than ten acres within a similar period—The Minor Gold Medal. To be lodged by 1st November in any year.

Reports in competition for Nos. 6 and 7 must state the particular mode of management adopted, the substances applied, the elevation and nature of the soil, its previous natural products, and the changes produced.

SECTION 3.—HIGHLAND INDUSTRIES AND FISHERIES.

FOR APPROVED REPORTS.

1. The best mode of treating native Wool; cleaning, carding, dyeing, spinning, knitting, and weaving by hand in the Highlands and Islands of Scotland. Five Sovereigns. To be lodged by 1st November 1890.

2. The best means of preventing the rapid extinction of the Lobster. Five Sovereigns. To be lodged by 1st November 1890.

3. The best means of utilising the Sprat Fisheries. Five Sovereigns. To be lodged by 1st November 1890.

SECTION 4.—MACHINERY.

FOR APPROVED REPORTS.

On the advantages or disadvantages of using the American Chilled Plough in comparison with the old Scotch or Swing Plough. Ten Sovereigns. Reports to be lodged by 1st November 1891.

The Reporter must state the condition of the ground in spring after an autumn ploughing by both kinds of ploughs—the effect on after crops—comparative draught, and cost of working per acre.

SECTION 5.—FORESTRY DEPARTMENT.

FOR APPROVED REPORTS.

1. On Plantations of not less than eight years' standing formed on deep peat bog—The Medium Gold Medal, or Five Sovereigns. To be lodged by 1st November 1890.

The premium is strictly applicable to deep peat or flow moss; the condition of the moss previous to planting, as well as at the date of the Report, should, if possible, be stated.

The Report must describe the mode and extent of the drainage, and the effect it has had in subsiding the moss—the trenching, levelling, or other preliminary operations that may have been performed on the surface—the mode of planting—kinds, sizes, and number of trees planted per acre—and their relative progress and value, as compared with plantations of a similar age and description grown on other soils in the vicinity.

2. On the more extended introduction of hardy, useful, or ornamental Trees, which have not hitherto been generally cultivated in Scotland—The Medium Gold Medal, or Five Sovereigns. To be lodged by 1st November in any year.

The Report should specify as distinctly as possible the kind of trees introduced. The adaptation of the trees for use or ornament, and their comparative progress, should be mentioned. Attention is directed to the introduction of any tree as a nurse in young plantations, which by growing rapidly for several years, and attaining maturity when at the height of 20 or 25 feet, might realise the advantage and avoid the evils of thick planting.

3. On the Life-History of any Insect or Tribe of Insects which is injurious to British Forest Trees (*e.g.*, *Scolytus destructor*, of the Elm)—Fifteen Sovereigns. To be lodged by 1st November 1890.

The means for guarding against or destroying these pests to be mentioned, and the Report to be illustrated by original drawings and specimens of the insect and its ravages.

4. On the Utilisation of Waste Produce of Forests and Woodlands—Ten Sovereigns. To be lodged by 1st November 1890.

CLASS II.

DISTRICT COMPETITIONS.

REGULATIONS 1890.

The Money Premiums and Medals awarded at District Competitions will be sent direct to the winners in January next. No payments must, therefore, be made by the Secretary or Treasurer of any local Association.

Grants in aid of DISTRICT COMPETITIONS *for* 1891 *must be applied for before* 1*st November* 1890, *on Forms to be obtained from the Secretary.*

When a Grant has expired, the District cannot apply again for aid for two years.

SECTION I.—GRANTS TO DISTRICT SOCIETIES FOR HORSES, CATTLE, SHEEP, AND PIGS.

1. CLASS OF STOCK—LIMIT OF GRANTS, £340.—The Highland and Agricultural Society will make Grants to District Societies to deal with, as in the opinion of the District Societies the need of each district may require, for such classes of breeding Stock of Horses, Cattle, Sheep, and Pigs as are embraced in the General Show Prize List of the Highland and Agricultural Society. The total sum to be expended by the Highland and Agricultural Society in such Grants shall not exceed the sum of £340 in any one year.

2. Grant to District, £12.—The portion of the Grant to any one District Society shall not exceed the sum of £12 in any one year.

3. Continuance of Grant Three Years—Advertising.—The Grant shall continue for three alternate years, provided always that the District Society shall, in the two intermediate years, continue the competition by offering Premiums equal in amount to not less than one-half the sum given by the Highland and Agricultural Society, and for the same class of Stock as that selected in each previous year to compete for the Highland and Agricultural Society's Prizes. The Prizes when given by the Highland and Agricultural Society must be announced as their gift. If no competition takes place for two years the Grant expires.

4. Medals.—In the two alternate years the Highland and Agricultural Society will place three Minor Silver Medals at the disposal of the District Societies, for the same classes of Stock as those for which the Money Premiums are offered, provided that not less than three lots are exhibited in the same class.

5. Rules of Competition.—The Rules of Competition for the Premiums, the Funds for which are derived from Grants of the Highland and Agricultural Society, shall be such as are generally enforced by the Society receiving the Grant for Premiums offered by itself.

6. Area and Parishes—Five Parishes.—When making application for Grants from the Highland and Agricultural Society, the District Society must delineate the area and the number of parishes comprised in the district, and *except in special cases*, no District Society shall be entitled to a Grant whose show is not open to at least *five* Parishes.

7. Nomination of Members.—At the time of making a Grant to a District Society, the Directors shall nominate one or more members of the Highland and Agricultural Society resident in the district, whose duty it shall be to see that the conditions imposed by the Board are complied with.

8. Reports.—Blank Reports will be furnished to the Secretaries of the different District Societies. These Reports must in all details be completed and lodged with the Secretary of the Highland and Agricultural Society on or before the 1st of November next following the competition, both in the years when the Grant is given and in the two intermediate years, for the approval of the Directors of the Highland and Agricultural Society, against whose decision there shall be no appeal. All such Reports must be signed and certified by the Members of the Highland and Agricultural Society nominated under Rule 7.

9. Grants—When Paid.—The Grants made to District Societies will be paid in the January following the competition, by Precepts issued by the Directors of the Highland and Agricultural Society to the winners of the prizes. No payments of these Grants must be made by the Secretary or Treasurer of any District Society. Medals will be issued at the same time.

10. Renewal of Application.—No application for renewal of a Grant to a District Society will be entertained until the expiration of *two years* from the termination of the last Grant.

11. Disposal of Applications.—In disposing of applications for District Grants, the Directors of the Highland and Agricultural Society shall keep in view the length of interval that has elapsed since the expiration of the last Grant, giving priority to those District Societies which have been longest off the list.

12. Dairy Produce.—Upon application being made by District Societies, a limited number of Medals will be placed at the Disposal of District Societies for Dairy Produce.

N.B.—Existing Grants.—District Societies holding Grants under existing regulations shall have the option of continuing upon the present basis, or of placing themselves under the new regulations for the remaining years in which they are entitled to a Grant.

CTS.

1. Garioch.—*Convener*, Alex. M. Gordon, of Newton, Insch; *Secretary*, William Home, Newton of Ardoyne, Insch. Granted 1887. (In abeyance in 1888.)
2. Dalbeattie.—*Convener*, Wellwood H. Maxwell of Munches; *Secretary*, R. W. Macnab, Union Bank, Dalbeattie. Granted 1887. (In abeyance in 1888.)
3. Deeside Union.—*Convener*, Colonel Innes of Learney, Aberdeen; *Secretary*, James Shaw, Tillyching, Lumphanan. Granted 1888.
4. Turriff.—*Convener*, A. Stuart of Laithers, Turriff; *Secretary*, R. Cruickshank, Claymires, Turriff. Granted 1888.
5. Lammermoor Pastoral.—*Convener*, Richard Stephenson, Chapel, Duns; *Secretary*, A. M. Caverhill, Crichness, Duns. Granted 1888.
6. Biggar.—*Convener*, R. G. Murray, Spittal, Biggar; *Secretary*, John H. Wilson, Biggar. Granted 1888.
7. Breadalbane.—*Convener*, Killin; *Secretary*, R. A. Robertson, Bank of Scotland, Killin. Granted 1888.
8. Wester Ross.—*Convener*, Major Randle Jackson of Swordale, Evanton; *Secretary*, David Ross, Dingwall. Granted 1888.
9. Eastern District of Stirlingshire.—*Convener*, Ralph Stark of Summerford, Falkirk; *Secretary*, Thos. Binnie, Auctioneer, Falkirk. Granted 1888.
10. Gargunnock.—*Convener*, Robert Thomson, Burnbank, Blair-Drummond; *Secretary*, M. C. Stark, Westerton, Doune. Granted 1887.
11. Sutherland.—*Convener*, J. B. Dudgeon, Crakaig, Golspie; *Secretary*, J. Mackintosh, Proncy, Dornoch. Granted 1887.
12. Stranraer and Rhins of Galloway.—*Convener*, R. Vans Agnew of Sheuchan, Park House, Stranraer; *Secretary*, Hugh Adair, National Bank, Stranraer. Granted 1887.

In 1890.

Nos. 1, 2, 3, 4, 5, 6, 7, 8, and 9 are in competition for the second year.
Nos. 10, 11, and 12 compete for local Premiums.

Section 2.—GRANTS TO HORSE ASSOCIATIONS, &c., FOR STALLIONS FOR AGRICULTURAL PURPOSES.

1. Horses—Limit of Grant, £210.—The Highland and Agricultural Society will make Grants to Horse Associations and other Societies in different districts engaging Stallions for agricultural purposes. The total sum expended by the Highland and Agricultural Society in such Grants shall not exceed the sum of £210 in any one year.

2. Grant to each, £15.—The portion of the Grant to any one Horse Association, &c., shall not exceed the sum of £15 in any one year.

3. Continuance of Grant Three Years—Intermediate Year.—The Grant shall continue for three alternate years, provided always that the Horse Association or Society shall, in the two intermediate years, offer at least a sum equal in amount to that granted by the Highland and Agricultural Society for the hire of a Horse in connection with the Association or Society to whom the Grant is made.

4. Nomination of Members.—At the time of making the Grant to a Horse Association or Society, the Directors of the Highland and Agricultural Society shall nominate one or more members of the Highland and Agricultural Society, resident in the Districts in which the Society benefited is located, whose duty it shall be to see that the conditions imposed by the Board are complied with.

5. Reports—Penalty for not engaging Horse.—No grant by the Highland and Agricultural Society to Horse Associations, &c., will be paid unless a report, signed and certified by the members appointed under Rule 4, be furnished to the Highland and Agricultural Society not later than the 1st of November in each year in which the Grant is made, and also in the alternate years, stating that a Horse has been engaged by the Horse Association or other Society to whom the Grant is made; and in the event of a Horse not being engaged in any one year while the provisions of the Grant are in force, the Grant made by the Highland and Agricultural Society will cease.

Rules 9 (Time of Payment), 10 (Renewal of Grant), and 11 (Disposal of Applications) applicable to section 1, shall be applicable to Section 2.

Districts.

1. Lockerbie.—*Convener*, D. J. Bell Irving, Waterside, Ecclefechan; *Secretary*, David Dobie, Becton, Lockerbie. Granted 1888.
2. Western District of Mid-Lothian.—*Convener*, James Paterson of Bankton, Mid-Calder; *Secretary*, John T. Mungle, West Calder. Granted 1888.
3. Dalbeattie District Horse Society.—*Convener*, John Frazer, Maxwellfield, Dumfries; *Secretary*, Thomas Smith, Ladyland, Dumfries. Granted 1888.
4. Elgin and Northern District Clydesdale Horse Society.—*Convener*, William Robertson, Linkwood, Elgin; *Secretary*, James Sutor, Solicitor, Elgin. Granted 1889.
5. Lanark Clydesdale Horse Society.—*Convener*, James Weir, Sandilands, Lanark; *Secretary*, James Renton, Cleghorn, Lanark. Granted 1889.
6. Selkirk and Galashiels.—*Convener*, John Scott of Gala, Galashiels; *Secretary*, Andrew T. Elliot, Newhall, Galashiels. Granted 1887.

In 1890.

Nos. 1, 2 and 3 are in competition for the second year.
Nos. 4, 5, and 6 compete for local Premiums.

DISTRICT COMPETITIONS.

Premiums granted prior to 1887.

Section 1.—CATTLE.

Note.—The Society's Cattle Premiums were granted to each District for three alternate years, on condition that the District shall, in the two intermediate years, continue the Competitions by offering for the same description of Stock a sum not less than one-half of that given by the Society.

At the intermediate Competitions, three Minor Silver Medals will be placed at the disposal of the Committee, to be given along with the first prize in the three Classes of Cattle, provided there are not fewer than three lots exhibited in each Class.

The selection of the Breed is left to the local Committee.

DISTRICTS.

1. ROYAL NORTHERN.—*Convener*, Ranald Macdonald, Cluny Castle, Aberdeen; *Secretary*, George Bruce, 35 Market Street, Aberdeen. Granted 1886.

2. STRATHBOGIE.—*Convener*, James Bruce, Collithy, Gartly; *Secretary*, Andrew Cruickshank, 37 Gordon Street, Huntly. Granted 1886.

3. UNITED BANFFSHIRE.—*Convener*, John Hannay, Montcoffer, Banff; *Secretary*, Alexander Duncan, Banker, Banff. Granted 1886.

PREMIUMS.

1. Best Bull, 3-year-old and upwards, of any pure breed	£3
Second best	2
Third best	1
2. Best Bull, 2-year-old and under, of any pure breed	3
Second best	2
Third best	1
3. Best 2-year-old Heifer (if Highland breed, 3 years), of any pure breed	3
Second best	2
Third best	1
	£18

The dates of calving of cattle will be counted as from on and after January 1, except Aberdeen-Angus, which will be counted as from on and after December 1.

In 1890.

Nos. 1, 2, and 3 are in competition for the last year.

SECTION 2.—HORSES.

FOR AGRICULTURAL PURPOSES.

The Society's Stallion Premiums were granted to each District for two years, and were followed by Premiums for other two years for Brood Mares, and again for a similar period by Premiums for Entire Colts and Fillies.

The Stallion and Mare Premiums have now dropped, but the Premiums for Fillies and Colts are continued till the course is finished.

1. ENTIRE COLTS AND FILLIES.

1. INVERNESS.—*Convener*, Duncan Forbes of Culloden, Inverness; *Secretary*, George A. Walker, Torbreck, Inverness. Granted 1890.

2. KINROSS-SHIRE.—*Convener*, Thomas Steedman, Kinross; *Secretary*, John Hay, Balleave, Kinross. Granted 1890.

3. DUMBARTONSHIRE.—*Convener*, W. E. Gilmour, Woodbank, Alexandria, N.B.; *Secretary*, William Davie, jun., 99 Main Street, Alexandria, N.B. Granted 1889.

4. LOWER DISTRICT OF WIGTOWNSHIRE HORSE-BREEDING ASSOCIATION.—*Convener*, James Drew of Craigencallie, Doonhill, Newton-Stewart; *Secretary*, A. B. Matthews, Newton-Stewart. Granted 1889.

PREMIUMS.

		£	s.	d.
1.	Best Entire Colt, foaled after 1st January 1888	£2	0	0
	Second best	1	0	0
2.	Best Entire Colt, foaled after 1st January 1889	2	0	0
	Second best	1	0	0
3.	Best Filly, foaled after 1st January 1888	2	0	0
	Second best	1	0	0
	Third best	0	10	0
4.	Best Filly foaled after 1st January 1889	2	0	0
	Second best	1	0	0
	Third best	0	10	0
		£13	0	0

In 1890.

Nos. 1 and 2 are in competition for the first year.
Nos. 3 and 4 are in competition for the last year.

SECTION 3.—SHEEP.

Note.—The Society's Sheep Premiums were granted to each District for three alternate years, on condition that the District shall, in the two intermediate years, continue the Competitions by offering for the same description of Stock a sum not less than one-half of that given by the Society.

At the intermediate Competitions, four Minor Silver Medals will be placed at the disposal of the Committee, to be given along with the first prize in the four Classes of Sheep, provided there are not less than three lots exhibited in each Class.

The selection of the Breed is left to the Local Committee. See Rule 6.

DISTRICT.

1. ARRAN—*Convener*, Patrick Murray, Strabane, Brodick; *Secretary*, William Tod, Glenree, Lamlash. Granted 1886.

PREMIUMS.

1.	Best Tup above One Shear	£2
	Second best	1
2.	Best Shearling Tup	2
	Second best	1
3.	Best Three Ewes above One Shear	2
	Second best	1
4.	Best Three Gimmers or Shearling Ewes	2
	Second best	1
		£12

In 1890.

No. 1 is in competition for last year.

SECTION 4.—DAIRY PRODUCE.

Upon application being made by District Societies, a limited number of Medals will be placed at the disposal of District Societies for Dairy Produce.

RULES OF COMPETITION.

Applicable to Grants prior to 1887.

1. The Members of the Highland and Agricultural Society connected with the respective districts are appointed Committees for arranging the Competitions, the Convener being appointed by the Directors ; five members to be a quorum.

2. The Convener of each district shall summon a meeting of Committee for the purpose of determining the time and place of Competition, the nomination of Judges, and other preliminary arrangements. The time and place (which must be within the bounds of the District, unless in reference to Stallions) shall be publicly intimated by Conveners.

3. The Money Premiums awarded at District Competitions will be paid in January next, by precepts issued by the Directors. No payments must, therefore, be paid by the Secretary or Treasurer of any local Association. Medals will be issued at same time.

4. Stock must be the property of the Exhibitor at the date of entry. *No entry shall be received later than one week previous to the Show.* Entry Money shall not exceed 2½ per cent on the amount of the Premium to be competed for.

5. The Competitions (except for Stallions to serve in the District) must take place between the 1st of April and the 26th of October, and are open to general competition to all parties within the boundaries of the District of the local Society, whether members of local Association or not. The Stallion Premiums are open to all comers, or the Horses may be selected at the Glasgow Stallion Show on permission to that effect being obtained.

6. The Committee shall select the breed, and specify it in the returns. In Cattle the animals exhibited must belong to one of the following pure breeds—Shorthorn, Ayrshire, Polled (Galloway, Aberdeen-Angus), Highland. The Bulls may be of one breed, and the Heifers of another. In Sheep, the breeds must be Leicester, Cheviot, or Blackfaced.

7. Stock of an inferior description, or which does not fall within the prescribed regulations, shall not be placed for competition.

8. The Premiums shall not be divided. In Cattle, Horses (except Stallions to serve in the District), Sheep, and Swine, five lots in each Class will warrant the award of full, and three lots of half, Premiums. A Competitor may exhibit two lots in each Class, except in Dairy Produce, where only one lot is allowed from the same farm. No animal to be allowed to compete in more than one section.

9. To authorise the award of the Medals in the intermediate year, there must be not less than three lots in each Class, and the Society's Regulations must be adhered to.

10. An animal which has gained the Highland and Agricultural Society's first Money Premium at a previous District or General Show is inadmissible in the same Class (except in the case of Stallions); and one which has gained a second Money Premium can only thereafter compete in that Class for the first.

11. A Bull the property of two or more Tenants may compete, although the Exhibitors may not be Joint-Tenants.

12. Bulls for which Money Premiums are awarded may be required to serve in the District at least one season ; the rate of service to be fixed by the Committee, and the prizes may be withheld till the conditions are fulfilled. Premiums for the Heifers may be retained till the animals are certified to have calved.

13. Evidence must be produced that the Prize Stallions have had produce.

14. Mares must have foals at foot, or be entered as being in foal; in the latter case payment of the Premiums will be deferred till certificate of birth, which must be within 11 months from the date of the Show.

15. All Prize Tups must serve within the District during the season following the Competition. Ewes and Gimmers must be taken from the Exhibitor's stock, and must have been bred by him in the District; and Ewes must have reared Lambs during the ordinary season of the District.

16. Sheep must have been clipped bare during the season, and the Judges are instructed to examine the fleeces of the sheep selected for prizes, and to cast those on which they find any of the former fleece.

17. Should it be proved to the satisfaction of the Committee that an animal has been entered under a false name, pedigree, or description, for the purpose of misleading the Committee or Judges as to its qualification or properties, the case shall be reported to the Directors, and submitted by them to the first General Meeting, in order that the Exhibitor may be disqualified from again competing for the Society's Premiums, and his name, if he is a member, struck from the roll, or his case otherwise disposed of as the Directors may determine.

18. When an animal has previously been disqualified by the decision of any Agricultural Association in Great Britain or Ireland, such disqualification shall attach, if the Exhibitor, being aware of the disqualification, fail to state it and the grounds thereof in his entry, to enable the Committee to judge of its validity.

19. Competitors must certify that the Butter and Cheese exhibited by them are average specimens of the produce of their dairies in 1890, and that the quantity produced during the season has not been less than 1 cwt. of Butter, or 2 cwt. of Cheese.

20. It is to be distinctly understood that in no instance does any claim lie against the Highland and Agricultural Society for expenses attending a show of stock beyond the amount of Premiums offered.

21. Blank reports will be furnished to the Conveners and Secretaries of the different Districts. These must, in all details, be completed, and lodged with the Secretary *on or before the* 1*st of November next*, for the approval of the Directors, against whose decisions there shall be no appeal.

22. A report of the Competitions and Premiums awarded at the *intermediate* local shows in the several Districts for Cattle and Sheep, signed by a member of the Society, must be transmitted to the Secretary *on or before the* 1*st of November in each year*, otherwise the Society's grants shall terminate.

SECTION 5.—SPECIAL GRANTS.

£20 to the Ayrshire Agricultural Association, to be competed for at the Dairy Produce Show at Kilmarnock.—*Convener*, The Hon. G. R. Vernon, M.P., Auchans House, Kilmarnock; *Secretary*, James M'Murtrie, Ayr. Granted 1872.

£3 to Orkney.—*Secretary*, James Johnston, Orphir House, Orkney. Granted 1883.

£3 to Rousay.—*Convener*, General Burroughs of Rousay, C.B.; *Secretary*, R. Mainland, Banks, Frotoft, Rousay. Granted 1883.

£3 to South Uist and Barra.—*Convener and Secretary*, Donald Paterson, Askernish, South Uist, Oban. Granted 1890.

£3 to North Uist.—*Convener*, Sir John Campbell Orde, Bart.; *Secretary*, Granted 1890.

SECTION 6.—MEDALS IN AID OF PREMIUMS GIVEN BY LOCAL SOCIETIES.

The Society, being anxious to co-operate with local Associations, will give a limited number of Minor Silver Medals annually to Societies, not on the list of Cattle, Horse, or Sheep Premiums, in addition to the Money Premiums awarded in the Districts for—

1. Best Bull, Cow, Heifer of any pure breed, or Ox.
2. Best Stallion, Mare, or Gelding.
3. Best Tup, or Pen of Ewes or Wethers.
4. Best Boar, Sow, or Pig.
5. Best Coops of Poultry.
6. Best Sample of any variety of Wool.
7. Best Sample of any variety of Seeds.
8. Best managed Farm.
9. Best managed Green Crop.
10. Best managed Hay Crop.
11. Best managed Dairy.
12. Best Sweet-Milk Cheese.
13. Best Cured Butter.
14. Best sample of Honey, not less than 5 lb., taken without destroying the bees.
15. Best collection of Roots.
16. Best kept Fences.
17. Male Farm Servant who has been longest in the same service, and who has proved himself most efficient in his duties, and to have invariably treated the animals under his charge with kindness.
18. Female Servant in charge of Dairy and Poultry who has been longest in the same service, and who has proved herself most efficient in her duties, and to have invariably treated the animals under her charge with kindness.
19. Best Sheep-Shearer.
20. Most expert Hedge-Cutter.
21. Most expert Labourer at Draining.
22. Most expert Farm Servant at trial of Reaping-Machines.
23. Best Maker of Oat Cakes.

It is left to the local Society to choose out of the foregoing list the classes for which the Medals are to be competed.

The Medals granted previous to 1887 are for five years; those granted in or after 1887 are for two years.

In 1889 it was resolved that in future no Society shall receive more than two Medals for two years.

Aberdeenshire.

1. AUCHINDOIR, KILDRUMMY, AND TOWIE.—*Convener*, Carlos P. Gordon of Wardhouse, Insch; *Secretary*, James Walker, jun., Westside, Kildrummy. 2 Medals. 1890.
2. CROMAR, UPPER DEE, AND DONSIDE.—*Convener*, Sir John F. Clark of Tillypronie, Bart., Tarland; *Secretary*, William Thomson, Town and County Bank, Tarland. 2 Medals. 1890.
3. FYVIE.—*Convener*, James Mackie, Lewes, Fyvie; *Secretary*, James Ironside, Steinmanhill, Fyvie. 2 Medals. 1890.

4. KENNETHMONT.—*Convener*, Wm. A. Mitchell, Auchnagathle, Keig; *Secretary*, James R. Moir, 8 Leslie Place, Aberdeen. 2 Medals. 1889.

5. MAR.—*Convener*, George Still, Strathray, Kinaldie; *Secretary*, Silv. Campbell, jun., Tofthills, Kintore. 2 Medals. 1890.

6. NORTH-EAST ABERDEENSHIRE.—*Convener*, Alex. Lovie, Nether Boyndlie, Fraserburgh; *Secretary*, Charles Reid, Rathen. 2 Medals. 1890.

7. SLAINS. — *Convener*, Ranald Macdonald, Cluny Castle, Aberdeen; *Secretary*, Alex. Sim, Clochton, Slains, Ellon. 2 Medals. 1886.

Argyllshire.

8. ISLAY, JURA, AND COLONSAY.—*Convener*, J. S. R. Ballingall, Eallabus, Islay; *Secretary*, John Gillespie, Craigens, Islay. 2 Medals. 1890.

9. KINTYRE.—*Convener*, Alex. Weir, Gallowhill, Campbeltown; *Secretary*, Duncan Hamilton, Royal Bank, Campbeltown. 2 Medals. 1890.

10. MULL AND MORVERN.—*Convener*, James N. Forsyth, Quinish, Tobermory; *Secretary*, W. Maitland Malcolm, Auchnacraig, Mull. 2 Medals. 1890.

11. SOUTH OF MULL.—*Convener and Secretary*, W. Maitland Malcolm, Auchnacraig, Mull. 2 Medals. 1890.

Ayrshire.

12. ARDROSSAN.—*Convener*, Andrew Allan, Munnoch, Dalry, Ayr; *Secretary*, Andrew Stirrat, Land Surveyor, Saltcoats. 2 Medals. 1889.

13. CARRICK.—*Convener*, Alex. Cross of Knockdon, Maybole; *Secretary*, David Brown, Royal Bank, Maybole. 2 Medals. 1890.

14. COLMONELL AND BALLANTRAE.—*Convener*, Robert P. Wright, Downan, Ballantrae; *Secretary*, William Douglas, Commercial Bank, Ballantrae. 3 Medals. 1886.

15. COYLTON AND STAIR.—*Convener*, John Claud Hamilton, yr. of Sundrum, Ayr; *Secretary*, Robert Caldwell, Knockshoggle, Coylton, Ayr. 2 Medals, 1890.

16. CRAIGIE.—*Convener*, James Kilpatrick, Craigie Mains, Kilmarnock; *Secretary*, Andrew M'Farlane, Craigie, Kilmarnock. 2 Medals. 1890.

17. CUMNOCK.—*Convener*, James Murray, jun., Dumfries Arms Hotel, Cumnock; *Secretary*, John Hayman, Dumfries Estate Office, Cumnock. 2 Medals. 1889.

18. DALRYMPLE.—*Convener*, David Hunter, Guiltreehill, Maybole; *Secretary*, James Murdoch, Burnton, Dalrymple. 2 Medals. 1886.

19. DARVEL HORTICULTURAL, &c. — *Convener*, Alex. Steel, Burnhead, Darvel; *Secretary*, James Currie, Kirkland Park, Darvel. 4 Medals. 1886.

20. GALSTON, LOUDOUN, AND LANFINE.—*Convener*, J. R. Dempster, Stoneyhall, Galston; *Secretary*, And. Cameron, Newmilns. 2 Medals. 1890.

21. IRVINE.—*Convener*, James Stewart, Heathfield, Irvine; *Secretary*, A. C. M'Jannet, Writer, Irvine. 2 Medals. 1886.

22. KILMARNOCK.—*Convener*, J. H. Turner, The Dean, Kilmarnock; *Secretary*, James Wilson, Kilmarnock. 2 Medals. 1890.

23. MONKTON, NEWTON, PRESTWICK, AND ST QUIVOX.—*Convener*, Wm. Sloan, Brieryside, Monkton; *Secretary*, James Howat, The School, Prestwick. 2 Medals. 1886.

24. WEST KILBRIDE.—*Convener*, John Crawford, Milnstonford, West Kilbride; *Secretary*, Malcolm Logan, Kirkland, West Kilbride. 2 Medals. 1889.

Berwickshire.

25. LAUDERDALE.—*Convener*, Wm. Dickinson, Longcroft, Lauder; *Secretary*, Geo. L. Broomfield, Lauder. 2 Medals. 1890.

Dumbartonshire.

26. CUMBERNAULD. — *Convener*, J. W. Burns of Kilmahew, Cardross; *Secretary*, John Longwill, Royal Bank, Cumbernauld. 3 Medals. 1886.

Dumfriesshire.

27. MOFFAT AND UPPER ANNANDALE.—*Convener*, James Johnstone, Hunterheck, Moffat; *Secretary*, John Young, Moffat. 2 Medals. 1890.

Fifeshire.

28. AUCHTERMUCHTY.—*Convener*, Jas. Thom of Leden Urquhart, Strathmiglo; *Secretary*, Arch. Walker, Auchtermuchty. 2 Medals. 1890.

29. CUPAR AND NORTH OF FIFE.—*Convener and Secretary*, George Wallace, Cupar-Fife. 2 Medals. 1890.

30. WESTERN DISTRICT OF FIFE.—*Convener*, William Beveridge, East Grange, Dunfermline; *Secretaries*, Jas. Craig, Urquhart, Dunfermline, and Robert Husband, Dunfermline. 2 Medals. 1890.

Inverness-shire.

31. HIGHLAND POULTRY AND PIGEON.—*Convener*, John Cran, Kirkton, Bunchrew, Inverness; *Secretaries*, Kelly & Elliot, 4 Telford Terrace, Inverness. 2 Medals. 1889.

32. NORTHERN COUNTIES FAT SHOW.—*Convener*, Duncan Forbes of Culloden, Inverness; *Secretary*, F. Urquhart, 11 Union Street, Inverness. 2 Medals. 1890.

33. STRATHGLASS.—*Convener and Secretary*, James Fraser, Mauld, Beauly. 2 Medals. 1886.

Lanarkshire.

34. ABINGTON. — *Convener*, ; *Secretaries*, David Oswald, Abington, and John Morton, Nether Abington. 2 Medals. 1890.

Orkney.

35. ROUSAY.—*Convener*, Gen. Burroughs of Rousay, C.B.; *Secretary*, William Learmonth, Faraclett, Rousay. 2 Medals. 1886.

Perthshire.

36. Middle District of Athole and Tullymet.—*Convener,*
; *Secretary,* J. S. Grant, Ballinluig.
2 Medals. 1889.

37. Moulin.—*Convener and Secretary,* R. M'Gillewie, Dunkeld. 1 Medal. 1889.

38. Strathearn.—*Convener and Secretary,* Robert Gardiner, Henhill, Forteviot. 2 Medals. 1890.

39. Weem.—*Convener,* Sir Robert Menzies of Menzies, Bart.; *Secretary,* Allan Hutchinson, Camserney Cottage, Aberfeldy. 2 Medals. 1890.

Renfrewshire.

40. Renfrewshire.—*Convener,* Colonel Thomas Glen Coats of Ferguslie Park, Paisley; *Secretary,* William Bartlemore, 99 High Street, Paisley. 2 Medals. 1890.

41. Royal West Renfrewshire Horticultural.—*Convener,*
; *Secretary,* A. M'Naughton, 46 Brymner Street, Greenock. 1 Medal. Granted 1889. (In abeyance in 1889.)

Stirlingshire.

42. Falkirk Horticultural.—*Convener,* John Shields, Linlithgow; *Secretary,* James Lennox, Bells Wynd, Falkirk. 2 Medals. 1890.

Wigtownshire.

43. Newton-Stewart Horticultural.—*Convener,* A. B. Matthews, Newton-Stewart; *Secretary,*
2 Medals. 1890.

Applications from other Districts must be lodged with the Secretary of the Society *by 1st November next.*

RULES OF COMPETITION.

1. All Competitions must be at the instance of a local Society.

2. The classes for which Medals are granted must be in accordance with the list at page 58. The Committee shall select the classes, and specify them in the return.

3. In each District the Convener (who must be a member of the Society appointed by the Directors) shall fix the time and place of Competition, appoint the Judges, and make all other necessary arrangements, in concurrence with the other members of the Society, and the local Association of the District.

4. The Money Premiums given in the District must be £2 for each Medal claimed.

5. The Medal for Sheep-Shearing shall not be awarded unless there are three competitors, and it shall always accompany the highest Money Premium. There must not be fewer than two competitors in all the classes.

6. Blank reports will be furnished to all the Conveners and Secretaries of the different Districts. These must, in all details, be completed and lodged with the Secretary *on or before the 1st of November next*, with the exception of green crop reports, which must be forwarded on or before the 20th of December, for the approval of the Directors, against whose decisions there shall be no appeal.

7. When a grant has expired, the District cannot apply again for aid for two years, and if no competition takes place in a District for two years the grant expires.

SECTION 7.—PLOUGHING COMPETITIONS.

The Minor Silver Medal will be given to the winner of the first or highest Premium at Ploughing Competitions, provided a Report in the following terms is made to the Secretary, within one month of the Competition, by a Member of the Society:—

FORM OF REPORT.

I, of Member of the Highland
and Agricultural Society, hereby certify that I attended the Ploughing
Match of the Association at in the county
of on the when ploughs
competed; of land were assigned to each, and hours
were allowed for the execution of the work. The sum of £
was awarded in the following proportions, viz.:—

[*Here enumerate the names and designations of successful Competitors.*]

RULES OF COMPETITION.

1. All Matches must be at the instance of a local Society or Ploughing Association, and no Match at the instance of an individual, or confined to the tenants of one estate, will be recognised.

2. The title of such Society or Association, together with the name and address of the Secretary, must be registered with the Secretary of the Highland and Agricultural Society, 3 George IV. Bridge, Edinburgh.

3. Not more than one Match in the same season can take place within the bounds of the same Society or Association.

4. All reports must be lodged within one month of the date of the Match, and certified by a Member of the Highland and Agricultural Society who was present at it.

5. A Member can only report one Match, and a Ploughman cannot carry more than three Medals in the same season.

6. To warrant the grant of the Medal there must have been twelve ploughs in Competition, and Three Pounds awarded in Premiums by the local Society. The Medal to be given to the winner of the first or highest prize.

7. Ploughmen shall not be allowed any assistance, and their work must not be set up nor touched by others; on land of average tenacity the ploughing should be at the rate of an imperial acre in ten hours, and attention should be given to the firmness and sufficiency of the work below more than to its neatness above the surface.

CLASS III.

COTTAGES AND GARDENS.

The following Premiums are offered for Competition in the Parishes after mentioned.

The Premiums granted previous to 1887 are for five years; those granted after 1887 are for two years.

SECTION 1.—PREMIUMS FOR BEST KEPT COTTAGES AND GARDENS.

1. Best kept Cottage	£1 0 0
Second best	0 10 0
2. Best kept Cottage Garden	1 0 0
Second best	0 10 0

Ross-shire.

1. NOVAR.—*Convener*, Donald M'Raw, Moultavie, Alness; *Secretary*, D. M'Vicar, Evanton. Granted 1886.

Roxburghshire.

2. RULE WATER.—*Convener*, James T. S. Elliot of Wolfelee, Hawick; *Secretary*, Thomas Culbertson, Hobkirk, Hawick. Granted 1889.

RULES OF COMPETITION.

1. Competitions may take place in the different parishes for Cottages and Gardens, or for either separately.

2. The occupiers of Lodges at Gentlemen's Approach Gates and Gardeners' Houses are excluded, as well as others whom the Committee consider, from their position, not to be entitled to compete. The inspection must be completed by the 1st of October. In making the inspection, the Conveners may take the assistance of any competent judges.

3. It is left to the Committee of the District to regulate the maximum annual rent of the Cottages, which may, with the garden, be from £5 to £7.

4. To warrant the award of full Premiums, there must not be fewer than three competitors in each class. If there are less than three competitors in each class, only half Premium will be awarded.

5. A person who has gained the highest Premium cannot compete again.

6. If the Cottage is occupied by the proprietor, the roof must be in good repair; if the roof is thatch, it must be in good repair, though in the occupation of a tenant. The interior and external conveniences must be clean and orderly—the windows must be free of broken glass, clean, and affording the means of ventilation. Dunghills, and all other nuisances, must be removed from the front and gables. In awarding the Cottage Premiums, preference will be given to Competitors who, in addition to the above requisites, have displayed the greatest taste in ornamenting the exterior of their houses, and the ground in front and at the gables.

7. In estimating the claims for the Garden Premiums, the judges should have in view—The sufficiency and neatness of the fences and walks; the cleanness of the ground; the quality and choice of the crops; and the general productiveness of the garden.

8. Reports, stating the number of Competitors, the names of successful parties, and the nature of the exertions which have been made by them, must be transmitted by the Conveners to the Secretary *on or before the* 1*st November next.*

9. When a grant has expired, the District cannot apply again for aid for two years.

Parishes desirous of these Premiums must lodge applications with the Secretary *on or before the* 1*st November next.*

SECTION 2.—MEDALS FOR COTTAGES AND GARDENS OR GARDEN PRODUCE.

The Society will issue annually two Minor Silver Medals to a limited number of local Associations or individuals, who at their own expense establish Premiums for Cottages or Gardens under £15 of Rent. The Medals may be awarded for best kept Cottage, and best kept Garden or Flower Plot, or Garden Produce.

Local Associations or individuals desirous of these Medals, must lodge applications with the Secretary *on or before the 1st November next.*

The Medals granted previous to 1887 are for five years; those granted in or after 1887 are for two years.

Aberdeenshire.

1. PITCAPLE.—*Convener*, Henry Lumsden of Pitcaple, Pitcaple; *Secretary*, John Kissack, Logie Durno, Pitcaple. Granted 1889.

Edinburghshire.

2. RATHO.—*Convener*, John Usher of Norton, Ratho; *Secretary*, Thomas Hislop, Schoolhouse, Ratho. Granted 1886.

Fifeshire.

3. DYSART.—*Convener*, J. T. Oswald of Dunnikier, Kirkcaldy; *Secretary*, Samuel Herd, 182 St Clair Street, Kirkcaldy. Granted 1889.
4. LESLIE.—*Convener*, Hon. George Waldegrave-Leslie; *Secretary*, John Mitchell, North Street, Prinlaws, Leslie. Granted 1890.
5. NEWBURGH.—*Convener*, Geo. Dun, Ormiston, Newburgh; *Secretary*, Angus Cameron, Craigview, Newburgh. Granted 1890.

Inverness-shire.

6. PETTY, ARDERSIER, AND CULLODEN.—*Convener*, Duncan Forbes of Culloden, Inverness; *Secretary*, Wm. M'Culloch, Dalziel, Fort-George Station. Granted 1890.

Kinross-shire.

7. MILNATHORT.—*Convener*, William Tod, Gospetry, Milnathort; *Secretary*, Andrew Chalmers, Mill House, Milnathort. Granted 1890.

Stewartry of Kirkcudbright.

8. KIRKPATRICK-DURHAM.—*Convener*, James M'Queen of Crofts, Dalbeattie; *Secretary*, James G. Clingan, Kirkpatrick-Durham, Dalbeattie. Granted 1886.

Lanarkshire.

9. MIDDLE WARD OF LANARKSHIRE.—*Convener*, William Hamilton, High Motherwell, Motherwell; *Secretary*, James A. Young, Knowetop, Motherwell. Granted 1890.

10. RUTHERGLEN.—*Convener*, James Hunter, Coplawhill, Glasgow; *Secretary*, William Watson, 239 Main Street, Rutherglen. Granted 1886.

Nairnshire.

11. AULDEARN. — *Convener*, Major-General Duncan Baillie, Lochloy, Nairn; *Secretaries*, A. B. Davidson and A. J. Mackintosh, Auldearn. Granted 1889.

Perthshire.

12. ATHOLE. — *Convener*, Dr Irvine, Craigatin, Pitlochry; *Secretary*, Granted 1889.
(In abeyance in 1889.)

13. BREADALBANE, GLENLYON, WEEM, STRATHTAY, AND GRANTULLY.—*Convener*, Alexander Galloway, Dirgarve, Aberfeldy; *Secretary*, D. Macdiarmid, Bank of Scotland, Aberfeldy. Granted 1890.

14. DUNNING.—*Convener*, J. H. Mackie, Invermay, Forgandenny; *Secretary*, Johnstone Wright, Dunning. Granted 1890.

15. MEIGLE FLOWER AND POULTRY.—*Convener*, Andrew Bruce, Jordanstone, Meigle; *Secretary*, John Butter, Schoolhouse, Meigle. Granted 1889.

Renfrewshire.

16. KILBARCHAN. — *Convener*, Robert Wilson, Manswrae, Kilbarchan; *Secretary*, Archd. C. Buchanan, 4 Ewing Street, Kilbarchan. Granted 1886.

Ross-shire.

17. EDDERTON.—*Convener*, W. E. Catley of Edderton; *Secretary*, James Ross, Balblair, Edderton. Granted 1890.

18. STRATHPEFFER.—*Convener*, William Gunn, Nutwood, Strathpeffer; *Secretary*, Granted 1889.

REGULATIONS.

1. Competitions may take place in the different districts for Cottages and Gardens, or for either separately.
2. The annual value of each Cottage, with the ground occupied in the parish by a Competitor, must not exceed £15.
3. If Competition takes place for Garden Produce in place of the best kept Garden, such produce must be *bona fide* grown in the Exhibitor's Garden, and he will not be allowed to make up a collection from any other Garden.
4. To warrant the award of the Medals, there must not be fewer than three Competitors.
5. Blank reports will be furnished to the Conveners and Secretaries of the different Districts. These must, in all details, be completed and lodged with the Secretary *on or before the* 1*st November next*, for the approval of the Directors, against whose decisions there shall be no appeal.
6. When a grant has expired, the District cannot apply again for aid for two years.

SECTION 3.—IMPROVING EXISTING COTTAGES.

To the Proprietor in Scotland who shall report the Improvement of the greatest number of Cottages during the years 1887, 1888, and 1889—The Gold Medal.

SECTION 4.—BUILDING NEW COTTAGES.

To the Proprietor in Scotland who shall report the Erection of the greatest number of approved Cottages during the years 1886, 1887, 1888 and 1889—The Gold Medal.

RULES OF COMPETITION.

1. Claims for the Premiums Nos. 3 and 4 must be lodged with the Secretary on or before the 1st of October next, to allow an inspection to be made of the different Cottages. The inspection will be conducted by a Committee of the Society's Members, and Reports must be transmitted to the Secretary *on or before the* 1*st November next.*

2. The annual value of the Cottage or Cottages separately, with the garden ground, must not exceed £5.

3. In estimating the claims of the Competitors, the following points will be kept in view:—The external appearance of the Cottages; their internal accommodation; the arrangements of the out-houses; the means of drainage and ventilation; and the expense of the building or of the alteration, compared with its durability and accommodation. When the Cottages of one Competitor are superior in style and comfort to those of another, though not so numerous, the Inspectors will give them preference, provided they amount at least to three, and have been erected at a moderate expense.

4. Parties competing will forward to the Society Plans, Specifications, and Estimates, of which, and of all information sent therewith, copies may be taken for publication, if the Society shall see fit, and the originals returned to the parties within six months, if desired.

HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

GENERAL SHOW OF STOCK AND IMPLEMENTS

AT

DUNDEE,

ON 29TH, 30TH, AND 31ST JULY, AND 1ST AUGUST 1890.

LAST DAYS OF ENTRY.

IMPLEMENTS AND OTHER ARTICLES—Friday, 16th May.

STOCK, POULTRY, AND DAIRY PRODUCE—Friday, 13th June.

No Entry received later than those posted before 4 on Friday afternoon, 13th June, *except Post Entries for Stock only, posted before* 4 P.M. *on Thursday,* 19*th June, on payment of double Entry Money.*

COVERED BOOTHS FOR OFFICES—Friday, 13th June.

President of the Society.

THE RIGHT HON. THE EARL OF STRATHMORE, Glamis Castle, Glamis.

Convener of the Local Committee.

JOHN GILMOUR, Esq. of Montrave, Leven.

REGULATIONS.

GENERAL CONDITIONS.

1. The Competition is open to Exhibitors from all parts of the United Kingdom.

2. Every Lot must be intimated by a Certificate of Entry, lodged with the Secretary *not later than the* 16*th May for Implements and other Articles, and* 13*th June for Stock, Poultry, and Dairy Produce.* No Entry can be received later than those posted before 4 o'clock on Friday afternoon, 13th June, except Post Entries for Stock only, posted before 4 P.M. on Thursday, 19th June, on payment of *double Entry Money.* Printed forms will be issued on application to the Secretary, No. 3 George IV. Bridge, Edinburgh. Admission Orders will be forwarded to Exhibitors, by Post, previous to the Show.

3. Protests against the awards of the Judges, or against a violation of the judging regulations, must be lodged with the Secretary not later than

9 A.M. on Wednesday, 30th July, and parties must be in attendance at the Committee Room, in the Showyard, at 9.30 A.M. that day, when protests will be disposed of. All protests must be accompanied by the deposit of £2, 2s., and if not sustained the sum will be forfeited at the discretion of the Directors.

4. Protests lodged for causes which the protestor produces no good evidence to substantiate, will render him liable to be reported to the Board of Directors, with the view, if they see reason, of his being prohibited from again entering Stock for a General Show.

5. The Society shall not be liable for any loss or damage which Stock, Poultry, Dairy Produce, Implements, or other articles may sustain at the Show, or in transit.

6. The decisions of the Board of Directors are final in all questions respecting Premiums and all other matters connected with the Show, and it shall not be competent for any Exhibitor to appeal against such decisions to, nor seek redress in respect of them from, any other tribunal.

7. Covered Booths for Offices (9 feet by 9 feet), purely for business, not for exhibition of goods, can be had for £3, 10s. to Members and £5 to Non-Members. Intimation to be made to the Secretary on or before the 13th of June. Those applying after that date to pay double Entry Money, but no application can be received later than 10th July.

8. No lights allowed in the Yard at night, and Smoking is strictly prohibited within the Sheds. Those infringing this Rule will be fined 10s.

9. As the command of water in the Yard is limited, it is particularly requested that waste be avoided.

10. When the ground requires to be broken, the turf must be carefully lifted and laid aside, and the surface must be restored to the satisfaction of the Society, and at the expense of the Exhibitor.

11. All persons admitted into the Showyard shall be subject to the Rules and Orders of the Directors.

12. The Stewards have power to enforce the Regulations of the Society in their different departments, and to bring to the notice of the Directors any infringement thereof.

13. All persons in charge of Stock or other Exhibits shall be subject to the orders of the Stewards.

14. The violation by an Exhibitor of any one of the Regulations will involve the forfeiture of all Premiums awarded to him, or of such a portion as the Directors may ordain.

15. Railway Passes for unsold Stock and Implements must be applied for at the Committee Room in the Yard between 9 and 11 o'clock on the forenoon of Thursday and Friday.

16. The Show terminates at 5 P.M. on Friday, 1st August, and no animal or article can be withdrawn before that hour. Steam Engines not till 6 o'clock. Stock and Implements may remain in the Yard till Saturday afternoon.

17. The Premiums awarded will be paid in November 1890, and, with the exception of the Tweeddale Gold Medal and the Silver Medals, may be taken either in money or in plate.

STOCK AND POULTRY.

18. Poultry and Stock will be admitted on Monday, 28th July, and, with the exception of Horses, must be in the Yard before 12 o'clock that night. Horses must be in before 8 o'clock on the morning of Tuesday, except those entered for Jumping only, which do not require to be in till Wednesday morning before 8 o'clock. Judging to commence at 10 A.M. on Tuesday, 29th July. Exhibited on Tuesday, Wednesday, Thursday,

and Friday, 29th, 30th, and 31st July, and 1st August. Stock may be admitted on Saturday the 26th July, but only by sending information to the Secretary before the 24th July.

19. An animal which has gained a first Premium at a General Show of the Society cannot again compete in the same section.

20. All animals, except calves, foals, and lambs shown with their dams, must be entered in the sections applicable to their ages, and cannot be withdrawn after entry.

21. No animal to be allowed to compete in more than one section, except for Jumping.

22. Shorthorn, Aberdeen-Angus, and Galloway animals must be entered in the herd books, or the Exhibitor must produce evidence that his animal is eligible to be entered therein.

23. Stock must be *bona fide the property and in the possession of* the Exhibitor on the last day of Entry.

24. The Schedule of Entry must be filled up so far as within the knowledge of the Exhibitor.

25. The name of the Breeder, if known, must be given, and if the Breeder is not known, a declaration to that effect, signed by the Exhibitor, must be sent along with the Schedule, and no pedigree will be entered in the Catalogue when the Breeder is unknown.

26. Should it be proved to the satisfaction of the Directors that an animal has been entered under a false name, pedigree, or description, for the purpose of misleading the Directors or Judges as to its qualification or properties, or that information required in the Schedule and known or easily ascertained by the Exhibitor has been withheld, such animal may be disqualified either before or after a prize has been awarded to it, and the case may be reported to the first Meeting of Directors, in order that the Exhibitor may be disqualified from again competing at the Society's Shows, or his case otherwise disposed of as the Directors may determine.

27. When an animal has previously been disqualified by the decision of any Agricultural Association in the United Kingdom, such disqualification shall attach, if the Exhibitor, being aware of the disqualification, fail to state it, and the grounds thereof, in his entry, to enable the Directors to judge of its validity. Any person who is disqualified from exhibiting at any Show in the United Kingdom, shall be prohibited from exhibiting at any General Show of the Society unless with the special consent of the Board.

28. Breeding Stock must not be shown in an improper state of fatness, and the Judges are requested not to award Premiums to overfed animals.

29. Horses and Cattle must be paraded when required by the Stewards, and under their direction; and the prize animals will receive two Rosettes, which must be attached to the head of the animal, one on each side.

30. Exhibitors shall be answerable for all acts, whether committed by themselves, their servants, or others in charge of their Stock, and shall be responsible for the condition of their animals during the whole time they remain in the Showyard.

31. No animal to be taken out of its stall after 10 A.M. during the Show except by order of the Stewards, or with permission of the Secretary. Those infringing this Rule will be fined 10s.

32. Aged Bulls and Stallions must have had produce, and, along with Two-year-old Bulls, Three-year-old Colts, and aged Tups, have served within the year of the Show.

33. All Cows must have had calves previous to the Show, and when exhibited they must either be in milk or in calf; if in milk, birth must have been within 9 months of the Show; if in calf, birth must be certified within 9 months after the Show. This Rule does not apply to animals in Family Groups.

34. Cows in the Family Groups must have had calves previous to the Show, and when exhibited they must be either in milk or in calf. Two-year-old Heifers in the Family Group Prizes to be certified to have been served before the Show, except Highland Heifers, which need not be served till 3 years old.

35. All Milk Cows of the Ayrshire breed must be in the Yard on the evening of Monday, 28th July, before 8 o'clock, after which they will be inspected by the Veterinary Surgeon, or other official of the Society, between 8 and 9 o'clock, to see if they have been milked dry; and if not, they must be milked under his direction, and, after the judging, all Milk Cows must be milked morning and evening.

36. Any artificial contrivance or device of any description found on or proved to have been used on an animal, either for preventing the flow of milk or for any other improper purpose, will disqualify that animal from being awarded a Premium, and the Owner of said animal will be prohibited from again entering Stock for any of the Society's General Shows, or for such a period as the Directors may see fit.

37. Two-year-old Heifers—of the Shorthorn, Aberdeen-Angus, and Galloway Breeds—must be in calf when exhibited, and the Premiums will be withheld till birth be certified, which must be within 9 months after the Show. This Rule does not apply to animals in the Family Groups.

38. Animals of any age that have had a calf must be shown as Cows.

39. Mares in Section 5 must have produced foals after 1st January 1890, and foals must be at foot. In the case of a Mare whose foal has died, she shall without further entry be eligible to compete among the Yeld Mares. Mares in Section 6 must be in foal, and awards will be suspended till birth is certified, which must be within 11 months from the date of the Show.

40. With reference to Regulations 33 and 37, birth of at least a seven months' calf must be certified; and in regard to Regulation 39, birth of at least a nine months' foal.

41. No rug shall be hung up so as to conceal any animal in a horse-box or stall, except with special permission of the Steward of that department.

42. Horses entered as Hunters must be tried over the leaping-bar if required by the Judges.

43. Judges are particularly requested to satisfy themselves, as far as possible, regarding the soundness of all Horses before awarding the Prizes, and to avoid giving a preference to animals showing symptoms of hereditary diseases. The Judges may consult the Society's Veterinary Surgeon if they deem it expedient. No protests on veterinary grounds will be received.

44. All Ewes must have reared lambs in 1890; and Ewes of the Black-faced and Cheviot Breeds must be in milk, and have their lambs at foot.

45. Sheep must have been clipt bare after 1st January 1890, and the Judges are instructed to examine the fleeces of the Sheep selected for Prizes, and to cast those on which they find any of the former fleece.

46. Sows must have reared pigs in 1890 or be in pig; and Pigs must belong to the same litter, and be uncut.

47. In Poultry the Aged Birds must have been hatched previous to, and Cockerels and Pullets in, 1890.

48. Bulls must be secured by nose rings, with chains or ropes attached, or with strong halters and double ropes. All Cattle must be tied in their stalls.

49. Servants in charge of Stock must bring their own buckets or pails, and a piece of rope or sheep-net to carry their forage.

50. Loose boxes will be provided for Stallions, Three, Two, and One year-old entire Colts, and for Mares with foals at foot; closed-in stables

for all the other Horses, and covered accommodation for the whole of the other Stock.

51. Straw, hay, grass, and tares will be provided free by the Society during the four days of the Show. Animals in the Yard all Monday to get full rations; those arriving after 12 o'clock noon half rations; other kinds of food will be supplied at fixed prices in the Forage-yard. Any servant removing bedding from an adjoining stall will be fined in double the amount taken. Exhibitors may fetch their own cake or corn to the Yard, but not grass, tares, hay, nor straw. Coops, food, and attendance for Poultry will be found by the Society.

52. Cattle, Sheep, Swine, or Poultry cannot be removed from the Yard till 5 P.M. on Friday, 1st August, except on certificate by the Veterinary Surgeon employed by the Directors, countersigned by the Steward of the department and the Secretary.

53. Horses may be withdrawn at 6 o'clock on Tuesday evening and at 8 o'clock on Wednesday and Thursday evenings on a deposit of £5 for each animal, which shall be forfeited, along with any prize money it may have gained, if the animal is not brought back. They must return between 7 and 7.30 the following morning, and those not in before 8 will forfeit 10s. Horse passes to be applied for at the Committee Room between 5 and 6 P.M. on Tuesday, and the deposit will be returned between 12.30 and 2.30 on Friday.

54. When the Stock is leaving the Yard, no animal is to be moved till ordered by those in charge of clearing the Yard. Those transgressing this Rule will be fined 10s., and detained till all the other Stock is removed.

JUDGING STOCK AND POULTRY.

55. On Tuesday, 29th July, no person will be admitted, except Servants in charge of Stock, till 8 A.M., when the Gates are opened to the public.

56. The Judges will commence their inspection at 10 A.M. The space reserved for the Judges will be enclosed by ropes, and no encroachment will be permitted. In no case shall a Premium be awarded unless the Judges deem the animals to have sufficient merit; and where only one or two lots are presented in a section, and the Judges consider them unworthy of the Premiums offered, it shall be in their power to award a lower prize, or to suggest the removal of any lot which appears to them unworthy of being placed in the Yard.

57. In addition to the Premiums, the Judges are authorised to award three Commendations in each section (except Poultry, where only two Prizes are to be awarded), if the entries are numerous and the animals of sufficient merit. These Commendations to consist of:—Very Highly Commended, Highly Commended, and Commended.

58. The animals in Section 10 (Ayrshire Breed) which have not calved before the Show, will be judged along with the Cows in Calf, and those in Section 11 which have calved before the Show will be judged along with Cows in Milk.

59. Two Members of Committee and a Director will attend each section of the Judges. It will be their duty to bring the animals out to the Judges and to see that no obstruction is offered to them, and that the space reserved for them is not encroached on; to ticket the prize animals; to send the Nos. of prize animals to the Award Lectern; to assist the Judges in completing their reports; and should any difficulty arise, to communicate with the Stewards.

60. It shall not be competent for any Exhibitor, nor for his Factor or Land-Steward, to act as a Judge or attending Member in any class in which he is competing.

DAIRY PRODUCE.

61. Dairy Produce will be received in the Showyard on Monday, 28th July, and till 8 A.M. on Tuesday, 29th July. Judged at 10 A.M. on Tuesday. Exhibited Tuesday, Wednesday, Thursday, and Friday.

62. Dairy Produce must have been made on the Exhibitor's farm in 1890. No Exhibitor to show more than one lot in each section. At least 1 cwt. of the variety of Butter and 2 cwt. of that of the Cheese exhibited must have been made during the Season. The lots must be fair samples, and untasted. No lot can be removed from the Yard till 5 P.M. on Friday, 1st August.

STALL RENT.

63. The following rates shall be paid by Exhibitors when making their Entries :—

	Members.		Non-Members.	
	s.	*d.*	*s.*	*d.*
Cattle, each	15	0	25	0
Boxes for Stallions—3 and 2 year-old entire Colts, and Mares with Foals at foot	30	0	40	0
Boxes for one-year-old entire Colts	20	0	30	0
Stallions, 12 hands and under	15	0	20	0
Mares or Geldings, 12 hands and under	10	0	15	0
All other Horses, each	20	0	30	0
Sheep, per pen	10	0	15	0
Swine, per pen	15	0	20	0
Poultry, each entry	3	0	5	0
Dairy Produce, each entry	4	0	6	0
Stalls for Attendants, same rates as above.				
Covered Booths for offices, 9 feet by 9 feet	70	0	100	0
Newspaper offices . . £2, 10s.				

FINE FOR STOCK NOT FORWARD.

64. In order to lessen the number of vacant Stalls, the following fines will be imposed on all Exhibitors whose animals are not forward :—For Horses, 40s. ; Cattle, 20s. ; Sheep and Swine, 10s. ; Poultry, 5s. ;—this fine to be in addition to Entry Money. In the case of death or illness of an animal, a Veterinary Surgeon's Certificate is necessary for a remit of the fine.

EXTRA STALL FOR ATTENDANTS.

65. Exhibitors of Stock shall be entitled to take an extra Stall for the accommodation of their attendants without being liable to a fine, but they must state when making their Entry that the Stall is to be used for that purpose, and remit rent.

IMPLEMENTS AND OTHER ARTICLES.

66. Implements will be received in the Yard on Tuesday, 22d July, and till 5 o'clock on the afternoon of Monday, 28th July. Exhibited Tuesday, Wednesday, Thursday, and Friday, 29th, 30th, and 31st July, and 1st August. The Schedule of Entry must be filled up so far as within the knowledge of the Exhibitor, and prices must be stated.

67 No Money Prizes or Medals will be given for Implements of any

kind, and no inspection of them by Judges will take place, except those specified at page 84.

68. Agricultural Implements, and Implements and collections of articles not Agricultural, will be received for Exhibition, but the Secretary is entitled to refuse Entries from dealers in articles not deemed worthy of Exhibition.

69. Implements will be placed in the following sections—viz., 1st, Under Cover, for Agricultural Implements; 2d, Open, for Agricultural Implements; 3d, Exhibits not Implements of Husbandry, which will be placed apart from the Agricultural Implements, either under cover or open, as may be deemed necessary by the Secretary; 4th, Motion Yard; 5th, Open space for Agricultural Implements from local country operative Blacksmiths and Carpenters. See below.[1] Exhibitors must specify the space they require.

70. The articles of each Exhibitor must be all placed in one stand, except Implements in motion, and must not on any account extend beyond the width allowed. No article to be moved out of its stand, or the stand dismantled, till the termination of the Show, at 5 P.M. on Friday, 1st August. Those infringing this Rule will be fined 10s.

71. Exhibitors must arrange their own articles *within* the space allotted to them before 9 o'clock on Tuesday the 29th July, and to the satisfaction of the Stewards in charge of the Implement Yard.

72. All Machines requiring steam or fire must be entered as such in the Certificate; and will be placed in the Motion Yard. *Coke only to be used in all cases where fire is required after* 10 *o'clock* A.M. Those infringing this Rule will incur a penalty of £5.

73. No Steam Engine shall be driven in the Yard at a greater speed than 4 miles an hour.

74. Locomotive and Traction Engines and other Machines must not be moved from their places without permission of the Stewards, and must not leave their stands till 6 P.M. on Friday.

75. There must be attached to each Implement, when forwarded to the Show, a label bearing the Exhibitor's name, and that of the Implement.

76. The carriage of all Implements must be prepaid.

STALL RENT.

77. Ground to be taken in spaces of 10 feet frontage by 20 feet deep, except in Motion Yard, which is to be 10 feet or any larger amount of frontage by 50 feet deep. Except for exhibits not agricultural, no boarding shall exceed 4 feet in height.

78. The following rates shall be paid by Exhibitors when making their Entries:—

	Members.	Non-Members.
Implement Shedding, 20 feet deep, 7 feet high, per 10 feet	£1 5 0	£1 15 0
Implements without Shedding, 20 feet deep, per 10 feet	1 5 0	1 15 0
Implement space in Motion Yard, without Shedding, 50 feet deep, per foot . .	0 2 6	0 3 6
And with Shedding, 20 feet deep, 10 feet high, per foot	0 6 0	0 8 0
Covered Booth for offices, 9 feet by 9 feet each	3 10 0	5 0 0
Newspaper offices, each . . £2, 10s.		

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[1] In order to encourage exhibits of Agricultural Implements from local country operative Blacksmiths and Carpenters, open space will be provided for these in some less prominent part of the Yard at a charge of Entry Money of 1s. per running foot of frontage, 20 feet deep.

ADMISSION TO YARD.

The Public will be admitted on Tuesday, 29th July, at 8 A.M. The inspection by the Judges commences at 10 A.M. The charges will be—Tuesday, from 8 A.M. till 5 P.M., 5s.; Wednesday, from 8 A.M. till 5 P.M., 3s., from 5 P.M. to 8 P.M., 1s.; Thursday, from 8 A.M. till 8 P.M. 1s.; Friday, from 8 A.M. till 5 P.M., 1s.

Members of the Society are admitted to the Showyard without payment, on exhibiting a "*Member's Ticket,*" which is strictly not transferable. Tickets will be sent to all members residing in the United Kingdom whose addresses are known, and on no account will duplicates be issued. All Members not producing their tickets must pay at the gate, and the admission money will not be returned.

Exhibitors of Stock (not Members) are admitted free on producing their tickets.

Exhibitors of Implements (not Members) and their attendants will be entitled to free entry during the Show, but must remain at their stalls during the judging of the Stock on Tuesday.

Tickets for attendants on Stock and Implements are not available to admit to the Yard between 11 A.M. and 5 P.M.; and any attendant requiring to leave the Yard during the day cannot be again admitted except by a special pass (to be applied for at the Ticket Gate), which must be given up on his return.

Placards, except those of the Society, are prohibited both inside the Showyard and on the outside of the Boundary Fence, with the exception of those belonging to Exhibitors, whose right is confined to their own stalls. No newspapers or any other article allowed to be carried about the Yard for sale or display. No strolling bands or musicians admitted.

No Carriages or Equestrians admitted without special leave from the Directors, and then only for Invalids. Bath chairs may be brought in.

Premium Lists, Regulations, and Certificates of Entry may be obtained by applying at the Secretary's Office, No. 3 George IV. Bridge, Edinburgh.

All Communications should be addressed to FLETCHER NORTON MENZIES, Esq., *Secretary of the Highland and Agricultural Society of Scotland, No. 3 George IV. Bridge, Edinburgh.*

LAST DAYS OF ENTRY.

IMPLEMENTS AND OTHER ARTICLES—Friday, 16th May.
STOCK, POULTRY, AND DAIRY PRODUCE—Friday, 13th June.

No Entry received later than those posted before 4 o'clock on Friday afternoon, 13th June, except Post Entries for Stock only, posted before 4 P.M. on Thursday, 19th June, on payment of double Entry Money.

COVERED BOOTHS FOR OFFICES—Friday, 13th June.

RAILWAY ARRANGEMENTS.

The Railway Companies will be furnished with a list of the Exhibitors of Stock and Implements, after the 1st of July, and all applications for horse-boxes and trucks, and for information as to arrangements of Special Trains, must be made by the Exhibitors themselves with the Station-master where their stock is to be trucked.

The Railway Companies have adopted the following Regulations:—

STOCK AND EXHIBITS TO AND FROM AGRICULTURAL SOCIETIES' ANNUAL SHOWS, THE SMITHFIELD CLUB CATTLE SHOW, AND THE BRITISH FARMERS' DAIRY SHOW.

Live Stock.

1. Live Stock *to* the Show to be charged ordinary rates.
2. Live Stock *from* the Show, *if sold,* to be charged ordinary rates.
3. Live Stock *from* the Show, *if unsold,* to be conveyed at half rates back to the station whence they were sent, at owners' risk, on production of a certificate from the Secretary of the Agricultural Show to the effect that they are really unsold; failing production of such certificate, ordinary rates must be charged. The reduction to half rate is to be allowed only when the animals are returned by the same route as that by which they were conveyed *to* the Show. Minimum charge for Stock returned at half rates to be one-half the ordinary minimum.

If the unsold Live Stock which was conveyed on the outward journey by Passenger Train in horse-boxes be required to be returned by Goods Train in cattle trucks, half the Goods Train rates must be charged.

4. Live Stock rates are "station to station" only.
5. Unsold Live Stock transferred from one Agricultural Show to another, in another part of the country, must be charged ordinary rates.
6. Poultry to be charged ordinary rates both ways.
7. Horse-boxes must not be provided for the carriage of Live Stock sent by Goods Train and invoiced at Goods Train rates.
8. Provender conveyed to Agricultural Shows with Live Stock is to be charged ordinary rates, except so much of the same as may be required on the journey.
9. Men, certified by the owners to be *bona fide* in charge of Live Stock, to be conveyed free in the same train as the animals; the number not to exceed one man to each vehicle.

> NOTE.—*Upon both the outward and homeward journey a separate certificate must be given (upon the proper Form), which must be retained by the station-master at the outward or homeward starting-point, as the case may be.*

10. For men in charge of Live Stock forwarded by Goods Train, no separate pass must be issued, but the form of pass must be printed upon the Live Stock Ticket, which must be delivered up on the arrival of the Live Stock at their destination.

> NOTE.—*Regulations Nos.* 1-10 *as above apply also to Live Stock* to *and* from *all fixed periodical Horse and Cattle Shows where the animals are sent to compete for prizes.*

Agricultural Machines, Implements, and other Exhibits.

11. Agricultural Machines, Implements, and other Exhibits *to* the Show to be charged ordinary rates.

12. Agricultural Machines, Implements, and other Exhibits *from* the Show, *if sold*, to be charged ordinary rates.

13. Agricultural Machines, Implements, and other Exhibits *from* the Show, *if unsold*, to be conveyed at half rates back to the station whence they were sent, at owners' risk, on production of a certificate from the Secretary of the Agricultural Show to the effect that they are really unsold; failing production of such certificate, ordinary rates must be charged. The reduction to half rate is to be allowed only when the articles are returned by the same route as that by which they were conveyed *to* the Show.

14. The ordinary rates do not include delivery *to*, or collection *from*, the Show Ground.

15. Unsold goods transferred from one Agricultural Show to another, in another part of the country, must be charged ordinary rates.

16. Agricultural Societies' Show Plant must be charged at Special Class rates, station to station.

Tents, Canvas, &c.

17. Tents, Canvas, and other articles carried to Agricultural Shows, not for exhibition or sale, to be charged the usual rates both going and returning.

PREMIUMS.

In addition to the Premiums, the Judges are authorised to award three Commendations in each Section (except Poultry, where only two Prizes are to be awarded), if the Entries are numerous and the animals of sufficient merit. These Commendations to consist of—Very Highly Commended, Highly Commended, and Commended.

The Directors are willing to accept suitable Champion Cups or Prizes, of not less than £10 in value, for the recognised Breeds of Cattle, Horses, and Sheep, &c. Intimation to be made to the Secretary on or before 1st April.

CLASS I.—CATTLE.

		Premiums.			
	SHORTHORN.	1st.	2d.	3d.	
Section		£	£	£	
1.	Bull calved before 1st Jan. 1888	20	10	5	
2.	Bull calved on or after 1st Jan. 1888	15	10	5	
3.	Bull calved on or after 1st Jan. 1889	12	8	4	
	Breeder of Best Bull of any age in the three Sections,—The Silver Medal.				
4.	Cow of any age	12	8	4	
5.	Heifer calved on or after 1st Jan. 1888	10	5	3	
6.	Heifer calved on or after 1st Jan. 1889	10	5	3	
					£149
	AYRSHIRE.				
7.	Bull calved before 1st Jan. 1888	15	10	5	
8.	Bull calved on or after 1st Jan. 1888	12	8	5	
9.	Bull calved on or after 1st Jan. 1889	8	5	3	
	Breeder of best Bull of any age in the three Sections,—The Silver Medal.				
10.	Cow in Milk, of any age	12	8	4	
11.	Cow in Calf, of any age	10	7	3	
12.	Heifer calved on or after 1st Jan. 1888	10	5	3	
13.	Heifer calved on or after 1st Jan. 1889	8	5	3	
					149

Carry forward £298

Brought forward £298

ABERDEEN-ANGUS.

Section		Premiums. 1st. £	2d. £	3d. £	
14.	Bull calved before 1st Dec. 1887	20	10	5	
15.	Bull calved on or after 1st Dec. 1887	15	10	5	
16.	Bull calved on or after 1st Dec. 1888	12	8	4	
	Breeder of best Bull of any age in the four Sections,—The Silver Medal.				
	[1] Best Bull in the three Sections, £10.				
17.	Cow calved before 1st Dec. 1886	12	8	4	
18.[2]	Cow three years old, £12, £8, £4.				
19.	Heifer calved on or after 1st Dec. 1887	10	5	3	
20.	Heifer calved on or after 1st Dec. 1888	10	5	3	
	[3] Best Female Animal in the four Sections, £10.				
					149

GALLOWAY.

Section		1st. £	2d. £	3d. £	
21.	Bull calved before 1st Jan. 1888	20	10	5	
22.	Bull calved on or after 1st Jan. 1888	15	10	5	
23.	Bull calved on or after 1st Jan. 1889	12	8	4	
	Breeder of best Bull of any age in the three Sections,—The Silver Medal.				
24.	Cow of any age	12	8	4	
25.	Heifer calved on or after 1st Jan. 1888	10	5	3	
26.	Heifer calved on or after 1st Jan. 1889	10	5	3	
					149

HIGHLAND.

Section		1st. £	2d. £	3d. £	
27.	Bull calved before 1st Jan. 1888	20	10	5	
28.	Bull calved on or after 1st Jan. 1888	15	10	5	
29.	Bull calved on or after 1st Jan. 1889	12	8	4	
	[4] Best Bull in the three Sections, £10.				
	Breeder of best Bull of any age in the three Sections,—The Silver Medal.				
30.	Cow of any age	12	8	4	
31.	Heifer calved on or after 1st Jan. 1887	10	5	3	
32.	Heifer calved on or after 1st Jan. 1888	10	5	3	
	[4] Best Female Animal in the three Sections, £10.				
					149
					£745

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[1] Given by Miss Morison Duncan of Naughton.

[2] Given by Mr Macpherson Grant of Drumduan.

[3] Given by Mrs Morison Duncan of Naughton.

[4] Given by Mr Ogilvy Dalgleish of Errol Park.

CLASS II.—HORSES.

		Premiums.				
	FOR AGRICULTURAL PURPOSES.	1st.	2d.	3d.	4th.	
Section		£	£	£	£	
1.	Stallion foaled before 1st Jan. 1887	20	15	10	5	
2.	Entire Colt foaled on or after 1st Jan. 1887 . . .	15	12	8	4	
3.	Entire Colt foaled on or after 1st Jan. 1888 . . .	15	10	6	3	
4.	Entire Colt foaled on or after 1st Jan. 1889 . . .	12	7	4	2	
	Breeder of Best Male Animal of any age in the four Sections,—The Silver Medal.					
	[1] Best Stallion in the four Sections registered in Clydesdale Stud-Book, £25.					
5.	Mare of any age, with Foal at foot .	20	10	5	3	
6.	Mare (in Foal) foaled before 1st Jan. 1887	15	10	5	3	
7.	Filly foaled on or after 1st Jan. 1887	10	6	3	2	
8.	Filly foaled on or after 1st Jan. 1888	10	6	3	2	
9.	Filly foaled on or after 1st Jan. 1889	10	6	3	2	
	[1] Best Mare in the five Sections registered in Clydesdale Stud-Book, £25.					
						£282
	THOROUGH BRED.					
10.	[2] Yearlings the produce of the Queen's Premium - Stallions that have served in Scotland,—Five Prizes, £10, £7, £5, £2, £1.					
	HUNTERS AND ROADSTERS.					
11.	Mare or Gelding, suitable for field, foaled before 1st Jan. 1887 .	12	8	4		
12.	Mare or Gelding, suitable for field, foaled on or after 1st Jan. 1887 .	12	8	4		
	Carry forward	24	16	8		£282

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[1] Given by the Clydesdale Horse Society.

[2] Given by Mr Gilmour of Montrave, the Scotch representative on the Royal Commission on Horse Breeding.

Brought forward £282

HUNTERS AND ROADSTERS—*contd.*	Premiums. 1st.	2d.	3d.	
Section	£	£	£	
Brought forward .	24	16	8	
13. Mare or Gelding, suitable for field, foaled on or after 1st Jan. 1888 .	10	5	3	
14. Mare or Gelding, suitable as Hackney, to be exhibited in saddle only	8	4	2	
15. Mare or Gelding, suitable for driving, 3 years old and upwards, to be shown in harness and driven .	8	4	2	
16.[1] Horse or Mare, for jumping .	20	10	5	
				129

PONIES.				
17. Stallion, 15 hands and under .	6	3	1	
18. Mare or Gelding, between 13 and 14½ hands . . .	6	3	1	
19. Mare or Gelding, between 12 and 13 hands . . .	6	3	1	
20. Mare or Gelding, under 12 hands .	6	3	1	
21. Shetland Stallion, not exceeding 10¼ hands . . .	4	2	1	
22. Shetland Mare or Gelding, not exceeding 10¼ hands . .	4	2	1	
23.[1] Ponies, 14 hands and under, for jumping	5	3	1	
				63
				£474

CLASS III.—SHEEP.

BLACKFACED.	Premiums. 1st.	2d.	3d.	
Section	£	£	£	
1. Tup, above one shear . . .	12	8	4	
2. Shearling Tup	12	8	4	
3. Three Ewes, above one shear, with their Lambs at foot	10	5	2	
4. Three Shearling Ewes or Gimmers .	10	5	2	
				£82

Carry forward £82

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[1] Animals entered in the other Sections may compete for Jumping. Animals entered for Jumping only do not require to come to the Showyard till Wednesday morning before 8 o'clock.

Brought forward … … £82

CHEVIOT.

Section		Premiums. 1st. £	2d. £	3d. £	
5.	Tup above one shear	12	8	4	
6.	Shearling Tup	12	8	4	
7.	Three Ewes above one shear, with their Lambs at foot	10	5	2	
8.	Three Shearling Ewes or Gimmers	10	5	2	
					82

BORDER LEICESTER.

Tweeddale Gold Medal for best Tup, £20.

Section		1st. £	2d. £	3d. £	
9.	Tup above one shear	12	8	4	
10.	Shearling Tup	12	8	4	
11.	Three Ewes above one shear	10	5	2	
12.	Three Shearling Ewes or Gimmers	10	5	2	
					82

SHROPSHIRE.

Section		1st. £	2d. £	3d. £	
13.	Tup above one shear	12	8	4	
14.	Shearling Tup	12	8	4	
15.	Three Ewes above one shear	10	5	2	
16.	Three Shearling Ewes or Gimmers	10	5	2	
					82

OXFORD DOWN.

Section		1st. £	2d. £	3d. £	
17.	Tup above one shear	5	3	—	
18.	Shearling Tup	5	3	—	
19.	Three Ewes above one shear	5	3	—	
20.	Three Shearling Ewes or Gimmers	5	3	—	
					32

EXTRA SECTIONS.

Section		1st. £	2d. £	3d. £	
21.	Three Blackfaced Wethers, one shear	4	2	1	
22.	Three Cheviot Wethers, one shear	4	2	1	
23.[1]	Three Cross-bred Wethers, one shear	4	2	1	
					21

£381

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[1] Cross-bred Wethers must be the offspring of any Whitefaced or Short-Woolled Tup with Blackfaced Ewes, or the progeny of Blackfaced Tups with Whitefaced or Short-Woolled Ewes.

CLASS IV.—SWINE.

LARGE WHITE BREED.

Section	Premiums. 1st. £	2d. £	3d. £	
1. Boar	5	3	1	
2. Sow	4	2	1	
3. Three Pigs, not above 8 months old .	4	2	1	
				£23

WHITE BREED OTHER THAN LARGE.

Section	1st. £	2d. £	3d. £	
4. Boar	5	3	1	
5. Sow	4	2	1	
6. Three Pigs, not above 8 months old .	4	2	1	
				23

BLACK OR BERKSHIRE.

Section	1st. £	2d. £	3d. £	
7. Boar	5	2	1	
8. Sow	4	2	1	
9. Three Pigs, not above 8 months old .	4	2	1	
				23
				£69

EXTRA STOCK.

Animals not included in the Sections for Competition may be exhibited as Extra Stock, and will receive Honorary Premiums when specially commended, as follows:—

CATTLE AND HORSES.

Very highly commended .	Medium Gold Medal.
Highly commended .	Minor Gold Medal.
Commended . .	The Silver Medal.

SHEEP AND SWINE.

Very highly commended .	Minor Gold Medal.
Highly commended .	The Silver Medal.
Commended . .	Medium Silver Medal.

CLASS V.—POULTRY.

First Premium—One Sovereign; *Second Premium*—Ten Shillings—in all the Sections of Poultry.

Aged Birds must have been hatched previous to, and Cockerels and Pullets in, 1890.

	Section		Section	
Dorking—*Silver Grey*	1.	Cock	2.	Hen
	3.	Cockerel	4.	Pullet
Dorking—*Coloured*	5.	Cock	6.	Hen
	7.	Cockerel	8.	Pullet
Cochin-China	9.	Cock	10.	Hen
	11.	Cockerel	12.	Pullet
Brahmapootra	13.	Cock	14.	Hen
	15.	Cockerel	16.	Pullet
Spanish	17.	Cock	18.	Hen
	19.	Cockerel	20.	Pullet
Scotch Grey	21.	Cock	22.	Hen
	23.	Cockerel	24.	Pullet
Hamburg	25.	Cock	26.	Hen
	27.	Cockerel	28.	Pullet
Any other Pure Breed	29.	Cock	30.	Hen
	31.	Cockerel	32.	Pullet
Game—*Black or Brown Reds*	33.	Cock	34.	Hen
	35.	Cockerel	36.	Pullet
Game—*Any other Pure Breed*	37.	Cock	38.	Hen
	39.	Cockerel	40.	Pullet
Bantams—*Any Pure Breed*	41.	Cock	42.	Hen
	43.	Cockerel	44.	Pullet
Ducks—*White Aylesbury*	45.	Drake	46.	Duck
	47.	Drake (Young)	48.	Duckling
Ducks—*Rouen*	49.	Drake	50.	Duck
	51.	Drake (Young)	52.	Duckling
Ducks—*Any other Pure Breed*	53.	Drake	54.	Duck
	55.	Drake (Young)	56.	Duckling
Turkeys—*Any Pure Breed*	57.	Cock	58.	Hen
	59.	Cock (Poult)	60.	Hen (Poult)
Geese—*Any Pure Breed*	61.	Gander	62.	Goose
	63.	Gander (Young)	64.	Gosling

Amount of Poultry Premiums, £96

CLASS VI.—DAIRY PRODUCE.

Section.	Premiums. 1st. £	2d. £	3d. £	
1. Cured Butter, not less than 28 lb.	5	4	3	
2. Powdered Butter, not less than 7 lb.	5	4	3	
3. Fresh Butter, three 1-lb. rolls	5	4	3	
4. Two Sweet-milk Cheeses, not less than 30 lb., made according to any method	10	5	3	
				£54

No Exhibitor to show more than one lot in any Section.

CLASS VII.—IMPLEMENTS.

Section
1. Grist Mill—Premiums, £15 and £10.

The Mill to kibble, grind into fine meal, or bruise beans, Indian corn, oats, wheat, barley, and linseed, or a mixture of these as required by the Judges. Power and materials to be supplied by the Society.

The price of the Machine not to exceed £25; the indicated horse-power required not to exceed Eight horse-power.

GENERAL REGULATIONS FOR COMPETITIVE TRIALS.

1. Implements to be entered with the Secretary on or before 16th May. Received in the Yard on Tuesday, 22d July, and till 5 o'clock on the afternoon of Monday 28th. Exhibited Tuesday, Wednesday, Thursday, and Friday, 29th, 30th, and 31st July, and 1st August.

2. The price as entered in the Catalogue must be held the same till after the trials are over.

3. Implements must be *bona fide* the manufacture of the exhibitor, and fitted together by him, but portions of the machine or other article exhibited for competition may be purchased from other works Foreign makers may exhibit through their accredited agents.

4. The Premiums will not be awarded without thorough and exhaustive open and competitive trials.

5. The Directors shall have power to withhold the Prizes where there is not sufficient merit, or to apportion them as they think best.

Reference is made to the General Regulations for the terms on which other Implements and Machines may be exhibited at the Show.

CLASS VIII.—HIGHLAND INDUSTRIES AND FISHERIES.

		Premiums.		
		1st.	2d.	
Section		£	£	s.
1.	Collection of Kippered and Preserved Salmon	5	3	
2.	Collection of Preserved and Dried Sea-fish	5	3	
3.	Collection of hand-knitted Stockings or Hose, hand-spun, not less than six pairs, knitted by Exhibitor	3	2	
4.	Collection of Home-made Articles, made from Cheviot Wool, hand-spun and dyed, and hand-loom woven	5	2	10
5.	Collection of Home-made Articles, made from Blackfaced Wool, hand-spun and dyed, and hand-loom woven	5	2	10
6.	Collection of Yarn of Native Wool, hand-spun and home-dyed, not less than four cuts	3	2	
7.	Collection of Harris Embroidery	3	2	
				£46

ABSTRACT OF PREMIUMS.

Given by the Society.

		£	s.	d.
1.	Cattle	£745	0	0
2.	Horses	474	0	0
3.	Sheep	381	0	0
4.	Swine	69	0	0
5.	Poultry	96	0	0
6.	Dairy Produce	54	0	0
7.	Implements	25	0	0
8.	Highland Industries and Fisheries	46	0	0
9.	Six Silver Medals to Breeders	4	4	0
10.	Extra Stock, say	100	0	0
		£1994	4	0

Given by

1.	Mr Macpherson Grant of Drumduan	£24	0	0			
2.	Miss Morison Duncan of Naughton	10	0	0			
3.	Mrs Morison Duncan of Naughton	10	0	0			
4.	Given by Mr Ogilvy Dalgleish of Errol Park	20	0	0			
5.	Given by the Clydesdale Horse Society	50	0	0			
6.	Mr Gilmour of Montrave	25	0	0			
7.	Tweeddale Medal	20	0	0			
					159	0	0
					£2153	4	0

F. N. MENZIES, *Secretary.*

3 George IV. Bridge,
Edinburgh, *5th March* 1890.

MEMBERS ADMITTED SINCE THE LIST WAS PUBLISHED IN APRIL 1889.

ARRANGED ACCORDING TO SHOW DISTRICTS.

Elected 19th June 1889 and 22d January 1890.

1.—GLASGOW DISTRICT.

ARGYLL.

Admitted
1889 Cameron, Allan Gordon, of Barcaldine Castle, Taynuilt
1889 Campbell, Alex. James Henry, of Dunstaffnage, Oban
1890 Campbell, Robt. C. Graham, of Shirvan, Lochead Lodge, Ardrishaig
1889 Macdougall, Allan, Duntanachan, Taynuilt

AYR.

1890 Alston, H. R., Swindrige Muir, Dalry
1890 Brisbane, C. T., of Brisbane, Largs
1889 Fergusson, John Blackburn, Doonholm, Ayr
1890 Hamilton, Claude, Carbieston, Ayr

Admitted
1889 Murdoch, James, Burnton, Dalrymple, Ayr
1889 Montgomery, John, Meadowhead, West Kilbride

LANARK.

1889 Clark, Alexander, Todlaw, Lesmahagow
1889 Gilchrist, D. A., Bothwell Park Farm, Bothwell—*Free Life Member*
1889 Marshall, James, Airbles, Motherwell
1889 Smellie, James, Coursington, Motherwell
1889 Wood, Alexander, 8 and 10 Stockwell Street, Glasgow

RENFREW.

1889 King, Robert A., Fulwood, Linwood

2.—PERTH DISTRICT.

FIFE.

1890 Balfour, Francis, yr. of Fernie, Fernie Castle, Cupar-Fife
1889 Cheape, Mrs, of Wellfield, Strathmiglo
1890 Constable, John, M.D., Leuchars
1890 Duncan, Mrs. Morison of Naughton, Newport
1889 Purvis, Capt. A. B., R.A., Kinaldy, St Andrews
1890 Webster, Thomas, Nisbetfield, Ladybank

FORFAR.

(Western Division.)

1890 Baxter, George Washington, Ashcliff, Dundee
1890 Bell, William Forsyth, Barns of Claverhouse, Dundee
1890 Cox, Alfred W., Beechwood, Lochee
1890 Grant, Alex., Forfar
1890 Grant, John, Craig Mills, Dundee
1890 Henderson, William, Milton of Collace, Coupar-Angus
1889 Hendry, William, Mains of Coul, Kirriemuir
1890 Kidd, David, Ardlar, Coupar-Angus
1890 Marshall, James Scott, Wynton Chemical Works, Dundee
1890 Murray, J. Douglas, Viewbank, Meigle
1890 Scott, George C., The Retreat, Dundee
1890 Sharp, John, jun., Balmuir House, Dundee
1890 Shiell, John, Solicitor, Bank Street, Dundee
1889 Smart, John B., Pitairlie, Monifieth, Dundee

PERTH.

(Eastern Division.)

1890 Cox, Albert E., of Dungarthill, Dunkeld
1890 Henry, Charles C., St Martins, Perth
1890 M'Donald, James, City Mills, Perth
1890 Martin, John Claude, Hilton, Perth

3.—STIRLING DISTRICT.

CLACKMANNAN.

Admitted
1889 Dickie, Robert, Westertown, Dollar
1890 Mar and Kellie, the Earl of, Alloa Park, Alloa
1889 Sinclair, John, Harviestoun Farm, Dollar
1889 Younger, James, Arns Brae House, Alloa

DUMBARTON.

1889 Mackenzie, Robert, yr. of Caldarvan, Auchenfroe, Cardross

PERTH.

(Western Division.)

1890 Duncan, Hector Macduff, yr. of Damside, Auchterarder

Admitted
1889 Farquharson, Alexander J., Estate Office, Blair-Drummond—*Free Life Member*
1890 Strathallan, Viscount, Crosshill, Auchterarder

STIRLING.

1890 Blackburn, Adam, Killearn House, Glasgow
1890 Drummond, James W., Seed and Nursery Establishment, Stirling
1889 M'Kean, John, Ballewan, Strathblane
1890 Moir, Alastair E. Graham, of Leckie, Gargunnock
1890 Murray, J. Campbell, Blairquhosh, Strathblane
1890 Waters, J. C. Dun, of Craigton, Balfron

4.—EDINBURGH DISTRICT.

EDINBURGH.

1890 Brodie, William Alex. G., 15 Rutland Square
1890 Campbell, P. W., W.S., 36 Castle Street
1889 Dods, Archibald, Halflawkiln, Gorebridge
1889 Grey, John Edward, 20 Lauriston Place
1889 Lindsay, W. P., W.S., 16 Queen Street
1890 Murray, T. M., W.S., 13 Hill Street
1890 Mylne, James, W.S., 36 Castle Street
1890 Nisbet, Chris. C., of Stobshiel, W.S., 23 York Place
1890 Patten, Hugh, W.S., 59 Frederick Street
1889 Raeburn, Norman, 49 Manor Place—*Free Life Member*
1889 Robertson, Rt. Hon. J. P. B., Q.C., Lord Advocate
1889 Shiells, James, Muirhouse, Stow
1889 Thomson, George Munro, W.S., 1 Drumsheugh Place
1890 Wallace, Andrew, 3 Bernard Street, Leith
1889 Young, J. W., W.S., 22 Royal Circus

HADDINGTON.

1889 Bruce, John, Newlands, Haddington
1890 Davidson, William, Cattle Salesman, Haddington
1890 Elder, James, Haddington
1889 Lowson, James Grey F., Beltonford, Dunbar
1889 Murray, Rev. W. B., Morham Manse, Haddington
1889 Ogilvy, H. T. N. Hamilton, Biel, Prestonkirk
1889 Park, Wm. R., of Blegbie, Upper Keith

LINLITHGOW.

1889 Ferrier, Wm. C., Birkenshaw, Bathgate
1889 Russell, Thomas, Greenhill, Avonbridge
1889 Walker, Thos. Geo., Kilpunt, Broxburn

5.—ABERDEEN DISTRICT.

ABERDEEN.

1889 Gordon, Robert, Gordonston, Clatt, Kennethmont—*Free Life Member*
1889 Ledingham, J. K., Slap, Turriff—*Free Life Member*

BANFF.

1889 Cumming, J. F., Cardow, Craigellachie

FORFAR.

(Eastern Division.)

1889 Adam, John, Bolshan, Arbroath
1890 Arnot, David, Mains of Edzell, Brechin
1890 Bell, Thomas, M.R.C.V.S., Muirdrum, Carnoustie
1890 Collier, John W., Hatton, Carnoustie
1890 Fletcher, Chas. Fitzroy, of Letham Grange, Arbroath
1890 Kydd, James, Scryne, Carnoustie
1889 Miller, James, Balgillo, Broughty-Ferry
1890 Ogilvie, James Swan, Brackenbrae, Broughty-Ferry
1890 Souter, John, Auchrennie, Muirdrum, Carnoustie
1890 Taylor, Robt., Pitlivie, Carslougie House, Carnoustie

6.—DUMFRIES DISTRICT.

DUMFRIES.

1889 Mather, John Alfred, Eccles House, Thornhill
1890 Underwood, William, Ironmonger, Annan
1890 Williamson, Capt. Cecil Hedworth, Carnsalloch, Dumfries

KIRKCUDBRIGHT.

1890 Nicholson, William, Bombie, Kirkcudbright
1889 Picken, David L., Milton, Kirkcudbright

WIGTOWN.

1889 M'Master, Wm., junior, Cruggleton, Garlieston

7.—INVERNESS DISTRICT.

INVERNESS.

Admitted
1890 Ferguson, Fergus, Monkstad, Uig, Portree
1889 Fraser, Donald, of Millburn, Inverness
1889 Kemble, Major, Knock, Skye
1890 Kennard, Cecil, Tormore, Broadford, Skye
1889 Martin, Nicol, of Glendale, Dunvegan
1890 Tod, David, Kingsburgh, Portree

ROSS.

Admitted
1889 Middleton, T. H., Rosefarm, Invergordon—*Free Life Member*
1889 Scott, James, Balmaduthy, Munlochy

SUTHERLAND.

1890 Mackintosh, John, Proncy, Dornoch

8.—BORDER DISTRICT.

BERWICK.

1889 Elliot, Frank, Middlestots, Duns
1889 Millican, Gilbert T., Harelaw, Chirnside
1890 Scott, Thomas, Abbey St Bathans, Grants House
1890 Smith, Andrew, of Whitchester, Duns
1889 Wilkie, James Bruce, of Foulden, Berwick

PEEBLES.

1889 Smart, James, jun., Cowieslinn, Eddleston
1890 Tennant, Edward P., yr. of The Glen, Innerleithen

ROXBURGH.

1889 Curle, Alexander, of Priorwood, Melrose
1889 Fairfax, Rear-Admiral Henry, C.B., of Old Melrose
1889 Halliburton, J. H., Jed Bank, Jedburgh
1889 Hutton, John, V.S., Kelso
1889 Johnston, Wm. Lee, Oxnam Neuk, Jedburgh
1890 Karr, H. Seton, M.P., of Kippielaw, St Boswells
1890 Kidd, Henry, Lowood, Melrose
1890 Macgregor, Donald, Orchard House, Kelso
1889 Noble, Robt., of Borthwickbrae, Hawick
1889 Paton, Major James, of Crailing, Jedburgh
1889 Scott, The Hon. H. J., Mertoun, St Boswells
1889 Thomson, William, Whitelee, St Boswells
1890 White, Alex., Nottylees, Kelso

SELKIRK.

1889 Anderson, Thomas, of Ettrick Shaws, Selkirk
1889 Lawrence, David, Whytbank, Galashiels

ENGLAND.

1890 Colquhoun, William E. Campbell, yr. of Killermont, Osberton Grange, Worksop
1889 Toppin, John C., Musgrave Hall, Skelton, Penrith
1890 Webster, J. Hume, Marden Deer Park, Caterham Valley, Surrey

IRELAND.

1889 Purefoy, Edward B., Greenfields, Tipperary—*Free Life Member*

FOREIGN COUNTRIES.

1889 Cammack, John, M.R.C.V.S., Kimberley, South Africa

NUMBER OF MEMBERS.

Number of Members in List published in April 1889	5025
Number of Members admitted in June 1889	62
Number of Members admitted in January 1890	66
Number of Diploma Holders admitted in June 1889	7
	5160
Deduct estimated deaths, &c.	150
Total	5010

INDEX.

Aberdeen Cattle, Exclusion of, from Melrose Show, Discussion at Showyard Meeting, Appendix A, 22.
Abortion (Epizootic), by J. M'Fadyean, 389—Committee appointed to raise Subscriptions, Appendix A, 10—Report by Committee, Appendix A, 29.
Accounts. *See* Finance.
Agricultural Bursaries: Reports to Board and General Meetings, Appendix A, 9, 27—Bye-Laws, Appendix B, 12—Regulations and Examination Papers for 1889, Appendix B, 19.
Agricultural Class in Edinburgh University, Prizes awarded to Students, Appendix A, 55.
Agricultural Education: Report of Examinations for 1889, Appendix A, 17—Council, Board of Examiners, Bye-Laws, Syllabus of Examination, and Examination Papers for 1889, Appendix B, 11.
Agricultural Statistics of Scotland, 188.
Agriculture, Board of, Deputation to Lord Cranbrook, Appendix A, 5—Report to General Meeting, Appendix A, 17.
Aitken, Dr A. P.: Feeding Experiments in various parts of Scotland, 289—the ratio of Albumen to Carbohydrates most suitable in the Dietary of Feeding Cattle (Experiment X.), 289—the relative importance of Oil and Sugar as Bye-fodders (Experiment XI.), 319—the relative values of Cake and Mixed Grains (Barley and Oats) as Bye-fodders (Experiment XIII.), 327—Manurial Experiments, 332—the most Economical Turnip Manure (Experiment II.), 333—Slag *versus* Superphosphate (Experiment III.), 347—Bones *versus* Superphosphates (Experiment IV.), 350—Manuring of Beans, Oats, and Hay, 353—Pumpherston Experimental Station, 359—Grass Crop 1889, 359—Botanical Analyses of Second Year's Grass, 368—Analytical Associations, Report for 1889, 378—Analyses in connection with Feeding Experiments, 378—Laboratory Notes, 381—Reports to General Meetings, Appendix A, 15, 27.
Analytical Associations, 379—Method of Procedure to be followed in applying for Grants, Appendix B, 29—Grants to, Appendix B, 38.
Argyll Naval Fund, Statement regarding, at Board and General Meetings, Appendix A, 11, 26—Accounts for 1888-89, Appendix A, 62.

Bertram, James G.: Trawl-net Fishing, its effects on Marine Life, 58.
Botanical Department: Botanical Investigation of the Old Pastures of Scotland, by A. N. M'Alpine, 199—Investigation of Old Pastures, Appendix A, 5, 6, 9—Reports by Botanist to General Meetings, Appendix A, 16, 28—Scale of Charges and Instructions for selecting and sending Samples, Appendix B, 42.
Buchan, Dr Alexander: Meteorology of 1889, 181.
Bursaries. *See* Agricultural Bursaries.

Calf-Rearing, by Rev. John Gillespie, A.M., 252.
Cattle Insurance in the Rhins of Galloway, by W. H. Ralston, 19.
Cedar of Lebanon (*Cedrus libani*), by Robert Hutchison, 112.
Cereal and other Crops of Scotland for 1889, and Meteorology of the Year relative thereto, 160—Average produce of Cereal Crops, 189.
Chemical Department: Reports by Dr A. P. Aitken, Chemist to the Society,—Feeding Experiments in various parts of Scotland, 289—the ratio of Albumen to Carbohydrates most suitable in the Dietary of Feeding Cattle (Experiment X.), 289—the relative importance of Oil and Sugar as Bye-fodders (Experiment XI.), 319—the relative values of Cake and Mixed Grains (Barley and Oats) as Bye-fodders (Experiment XIII.), 327—Manurial Experiments, 332—the most Economical Turnip Manure (Ex-

periment II.), 333—Slag *versus* Superphosphate (Experiment III.), 347—Bones *versus* Superphosphates (Experiment IV.), 350—Manuring of Beans, Oats, and Hay, 353—Pumpherston Experimental Station, 359—Grass Crop 1889, 359—Botanical Analyses of Second Year's Grass, 368—Analytical Associations, Report for 1889, 378—Analyses in connection with Feeding Experiments, 378—Laboratory Notes, 381—Proceedings at Board Meetings and General Meetings, Appendix A, 7, 10, 15, 27—Motion by Mr Cowe at Melrose Showyard Meeting as to Experimental Stations, Appendix A, 21—Members' Privileges in respect of Analysis, Appendix B, 26—Instructions for selecting Samples for Analyses, Appendix B, 27—Local Analytical Associations, Appendix B, 28—Method of Procedure to be followed by Secretaries and Members of Analytical Associations applying for Grants, Appendix B, 29.

Colebrooke, Sir Edward, Bart., Death of, Appendix A, 12.

Committees for 1890, Appendix B, 8.

Contagious Diseases among Farm Stock, Motion by Mr Cowe at Melrose Showyard Meeting, Appendix A, 20.

Cottage and Garden Competitions: Report to General Meeting, Appendix A, 30—Premiums awarded in 1889, Appendix A, 54—Premiums offered in 1890, Appendix B, 63.

Cropping, Change in, to suit altered Conditions of Farming, by John Speir, 65.

Crops, Forage, suitable for Scotland, by John Speir, 96.

Dairy Department: Premium regarding Acidity in Milk, Appendix A, 10—Report to General Meeting, Appendix A, 29—Objects of, Appendix B, 43—Grants to Associations, Appendix B, 43.

Dempster, George, Ormiston Hall, Death of, Appendix A, 4.

Directors, Nomination of, by Show Districts, Appendix A, 8.

Directors and other Office-Bearers for 1890, Appendix B, 5.

District Competitions, Report to General Meeting, Appendix A, 30—Premiums awarded in 1889, Appendix A, 50—Premiums offered in 1890, Appendix B, 50.

Draught-Horses, System of Management in Breeding Studs of, by Archibald MacNeilage, 136.

Dundee Show, 1890—Board resolve to hold the Show at Dundee, Appendix A, 3—Proceedings in regard to, Appendix A, 8, 11, 15, 26, 27.

Epizootic Abortion, by J. M'Fadyean, 389—Report by Committee, Appendix A, 29.

Essays and Reports, Premiums awarded for, in 1889, Appendix A, 31—Premiums offered for, in 1890, Appendix B, 45.

Establishment for 1890, Appendix B, 5.

Examiners in Agricultural Education, Appendix B, 11—Forestry Department, Appendix B, 21.

Experimental Stations, Motion by Mr Cowe at Melrose Showyard Meeting, Appendix A, 21.

Farming, Change in Cropping to suit altered Conditions of, by John Speir, 65.

Farming (Fruit), by Cecil H. Hooper, 232.

Feeding Experiments in various parts of Scotland, by Dr Aitken, 289.

Finance: Report to General Meeting, January 1890, Appendix A, 25—State of the Funds of the Society at 30th November 1889, Appendix A, 56—View of the Income and Expenditure for Year 1888-89, Appendix A, 57—Abstract of the Accounts for 1888-89, Appendix A, 58—Abstract of the Accounts of the Melrose Show, 1889, Appendix A, 60—Abstract of the Accounts of the Argyll Naval Fund for 1888-89, Appendix A, 62.

Fish Life: Marine Life destroyed by the Trawl, and its influence on, by Mr Anderson Smith, 44—Trawl-net Fishing, its effect on Marine Life, by James G. Bertram, 58.

Forage Crops suitable for Scotland, by John Speir, 96.

Forestry Department: The Growth of Trees, by Dr William Somerville, 26—Trees and Shrubs for planting as Shelter, by Robert Hutchison, 50—Trees and Shrubs for planting as Shelter, by A. D. Webster, 78—the Cedar of Lebanon, by Robert Hutchison, 112.

Forestry Department: Recommendations by Committee that a Board of Forestry be established, Appendix A, 5, 17—Memorial to President of Board of Agriculture, Appendix A, 11, 29—Board of Examiners, Syllabus of Examination, and Examination Papers, 1888, Appendix B, 21.

Free Life Members elected, Appendix A, 13.

Fruit-Farming, by Cecil H. Hooper, 232.

Galashiels Farmers' Club, Letter from, on preserving the public right to use the old Drove Roads, Appendix A, 11.

Galloway, Cattle Insurance in the Rhins of, by W. H. Ralston, 19.

Gillespie, Rev. John, A.M.: Calf-Rearing, 252.

Gladstone, Sir Thomas, of Fasque, Bart., Death of, Appendix A, 4.

Grasses. See Pastures.

Gray, William, Southfield, Death of, Appendix A, 10.

Hart, John: Report of Experiments with Turnip Manure in Kincardineshire, 267.

Heriot-Watt College, Motion in regard to Grant to, Appendix A, 2.

Highland and Agricultural Society, Pro-

ceedings at Board and General Meetings, Appendix A, 1—Constitution and Management, Appendix B, 4—Establishment for 1890, Appendix B, 5—Meetings for 1890, Appendix B, 7—Committees for 1890, Appendix B, 8.
Highland Industries and Fisheries, Area of, Appendix A, 10—Prizes offered, Appendix B, 49, 85.
Hooper, Cecil H.: Fruit-Farming, 232.
Horses, System of Management in Breeding Studs of Draught, by Archibald MacNeilage, 136.
Hutchison, Robert: Trees and Shrubs best adapted for planting as Shelter in the Islands of Scotland, 50—The Cedar of Lebanon (*Cedrus libani*), 112.

Insurance (Cattle) in the Rhins of Galloway, by W. H. Ralston, 19.
Irish Cattle Traffic, Appendix A, 3, 4, 9, 10, 18.
Irvine, Alexander Forbes, of Drum, Thanks voted to, on retiring from the Chairmanship of the Committee on Publications, Appendix A, 2, 17.

Judges, Nomination of, Appendix A, 1.

Keir, Patrick Small, of Kindrogan, Death of, Appendix A, 9.

Lebanon, the Cedar of (*Cedrus libani*), by Robert Hutchison, 112.
Live Stock, Movement of, to and from Markets, Appendix A, 11.

M‘Alpine, A. N.: Botanical Investigation of the Old Pastures of Scotland, 199—Reports on Botanical Department to General Meetings, Appendix A, 16, 28.
M‘Fadyean, J.: Epizootic Abortion, 389.
MacNeilage, Archibald: System of Management in Breeding Studs of Draught-Horses, 136.
Manure, Experiments with Turnip, by John Hart, 267.
Manurial Experiments, 332.
Margarine Cheese, Report by Deputation to Board of Trade, Appendix A, 5—Report to General Meeting, Appendix A, 19.
Marine Life destroyed by the Trawl, and its influence on Fish Life, by W. Anderson Smith, 44.
Marine Life, Trawl-net Fishing: its effects on, by James G. Bertram, 58.
Meetings of Society for 1890, Appendix B, 7.
Melrose Show, 1889, Report on, 128—Proceedings in regard to, Appendix A, 1, 3, 4, 6, 7, 8, 13, 20, 26—Exclusion of Aberdeen Cattle from, Appendix A, 22—Premiums awarded, Appendix A, 31—List of Judges and Attending Members, Appendix A, 48—Abstract of Accounts, Appendix A, 60.
Memorials or Petitions: To the Surveyor-General of the Ordnance Survey, Appendix A, 1—To the Prime Minister requesting that Cabinet rank be conferred upon the Secretary for Scotland, Appendix A, 7—To President of Board of Agriculture as to Board of Forestry, Appendix A, 11, 29—To the House of Commons on Mr Haldane's Truck Act Amendment Bill, Appendix A, 19.
Meteorology of 1889, by Dr Alexander Buchan, 181.

Nomination of Directors by Show Districts, Appendix A, 8—Dates of Meetings for, Appendix B, 7.
Nomination of Judges, Appendix A, 1.

Office-Bearers of the Society for 1890, Committee to prepare List of, Appendix A, 8—Election of, Appendix A, 25—List of, Appendix B, 5.
Ordnance Survey, Memorial to the Surveyor-General, Appendix A, 1—Reply to Memorial, Appendix A, 3, 6—Report to General Meeting, Appendix A, 18.

Pasture Grasses, Vote of £30 towards a Botanical Investigation of Old Pastures, Appendix A, 5, 6—Vote of £50 recommended, Appendix A, 11.
Pastures, Botanical Investigation of the Old, of Scotland, by A. N. M‘Alpine, 199.
Pleuro-Pneumonia: Privy Council to be memorialised, Appendix A, 3—Report by Deputation to Privy Council, Appendix A, 4, 17—Report to General Meeting, 22d January 1890, Appendix A, 30.
Ploughing Competitions held in 1888-89, Appendix A, 54—Regulations for, Appendix B, 62.
Polwarth, Lord: Vote of Thanks to, on retiring from Office of President, Appendix A, 25.
Premiums awarded in 1889, Appendix A, 31—offered in 1890, Appendix B, 45.
Proceedings at Board and General Meetings, Appendix A, 1.
Pumpherston Experimental Station, 259.

Railway Rates Inquiry, Proceedings of Committee on, Appendix A, 4, 6, 7, 19.
Railway Refrigerator Trucks or Cars, by D. Tallerman, 1.
Ralston, W. H.: Cattle Insurance in the Rhins of Galloway, 19.
Refrigerator Trucks or Cars (Railway), by D. Tallerman, 1.
Rotations, Change in Cropping to suit altered Conditions of Farming, by John Speir, 65.
Royal Agricultural Society of England, Celebration of the Fiftieth Anniversary of the Incorporation, Appendix A, 4—Invitation to attend the Windsor Show, Appendix A, 7.

Secretary for Scotland, Memorial to Prime

Minister requesting that Cabinet rank be conferred on the, Appendix A, 7.
Sheep, Prices of, since 1818, 196.
Showyard Arrangements: Suggestions by Committee, Appendix A, 10, 11, 26.
Showyard Meeting at Melrose, Appendix A, 20.
Shrubs and Trees for planting as Shelter in the Islands of Scotland, by Robert Hutchison, 50—By A. D. Webster, 78.
Smith, W. Anderson: Marine Life destroyed by the Trawl, and its Influence on Fish Life, 44.
Somerville, Dr William: The Growth of Trees, 26.
Speir, John: Change in Cropping to suit altered Conditions of Farming, 65—Forage Crops suitable for Scotland, 96.
Statistics (Agricultural) of Scotland, 188.

Tallerman, D.: Railway Refrigerator Trucks or Cars, 1.
Transactions of the Society: Volume i. of Fifth Series submitted to General Meeting, along with Index to Fourth Series, Appendix A, 17.
Trawl, Marine Life destroyed by the, by W. Anderson Smith, 44.
Trawl-net Fishing, by Jas. G. Bertram, 58.
Trees, the Growth of, by Dr William Somerville, 26.
Trees and Shrubs for planting as Shelter in the Islands of Scotland, by Robert Hutchison, 50—By A. D. Webster, 78.
Truck Act Amendment Bill, Petition against, Appendix A, 6, 19.
Trucks or Cars (Refrigerator), by D. Tallerman, 1.
Turnip Manure, Experiments with, by John Hart, 267.

Veterinary Department: Epizootic Abortion, by J. M'Fadyean, 389—Inquiry into Abortion in Animals, Appendix A, 10—Contagious Diseases among Farm Stock, Resolution by Showyard Meeting at Melrose, Appendix A, 20—Report by Committee on Abortion in Animals, Appendix A, 29—Medals awarded to Students, Appendix A, 55—Note regarding the Institution of, Appendix B, 21.

Wakefield, W. H., of Sedgwick, Death of, Appendix A, 11.
Webster, A. D.: Trees and Shrubs best adapted for planting as Shelter in the Islands of Scotland, 78.
Wilson, Sir Jacob, Letter from, Appendix A, 8.
Wool, Prices of, since 1818, 198.

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